

REPORT
OF THE
DEPARTMENT OF MINES
FOR THE
FISCAL YEAR ENDING MARCH 31, 1924

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*To General His Excellency the Right Honourable Lord Byng, of Vimy, G.C.B.,
G.C.M.G., M.V.O., Governor General and Commander in Chief of the
Dominion of Canada.*

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to lay before Your Excellency, in compliance with 6-7 Edward VII, chapter 29, section 18, the report of the work of the Department of Mines, for the fiscal year ending March 31, 1924.

CHARLES STEWART,
Minister of Mines.

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REPORT
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DEPARTMENT OF MINES
FOR THE FISCAL YEAR ENDING MARCH 31, 1924

To the Honourable CHARLES STEWART,
Minister of Mines,
Ottawa.

SIR,—I have the honour to submit the Annual Report of the Department of Mines for the year ending March 31, 1924.

Included in this report are statements from the heads of branches, containing details of the operation and administration of these branches. Although the annual appropriations by Parliament for the use of these branches have not been increased, it has been possible to enlarge the scope of the work, partly by increasing the number of laboratory and field investigations, and partly by a greater output from the office in the form of papers and reports on the mineral resources and mining industries of the country. During the year some sixty-eight parties were in the field engaged in investigations relating to geology, mineral resources, ethnology, biology, and botany; the laboratory investigations embraced a wide range of subjects in the fields of chemistry, metallurgy, ore dressing, fuel testing, ceramics, and road materials.

The increasing demand from the technical and daily press for authoritative articles on various phases of the mining industry is becoming a heavy drain on the time of the technical staff, but has so far been fully met by the officers of the Department without at the same time too seriously interfering with the carrying on of their more important investigations. By an arrangement with the office of the Canadian High Commissioner in London, articles dealing with mining conditions or mineral resources are sent weekly to that office, from which they are distributed to a selected list of newspapers, journals, mining companies, brokers, trade commissioners, and others. This has been done with the object of interesting British capital in the mineral resources of Canada, and augmenting British investments in this country. This campaign has already borne much fruit and has resulted in a better understanding by British mining companies of Canadian mineral possibilities, especially in Ontario and Quebec. From information received at the High Commissioner's office, this service has been so appreciated that it is proposed to continue it.

In addition to the large number of memoranda prepared by the departmental officers in response to special inquiries, the following articles were prepared and sent out, exclusive of those appearing in the regular publications of the Department.

List of Papers Issued

- Recent Mining Development in Mayo, Yukon Territory, by W. E. Cockfield. Canadian Mining Journal, vol. XLIV, Dec. 14, 1923, pp. 980-981.
- The Silver-Lead Deposits of Mayo District, Yukon Territory, by W. E. Cockfield. High Commissioner, London.
- Recent Beaver River Silver-Lead Discoveries, by W. E. Cockfield. Press Despatch in Canadian Newspapers.
- Mining Activity in the Area between Portland Canal and Skeena Rivers, by George Hanson. Canadian Mining Journal, vol. XLV, No. 9, Feb. 29, 1924, pp. 198-200.
- Northwestern British Columbia, by George Hanson. Canadian Mining Journal, vol. XLV, No. 22, Feb. 29, 1924, pp. 521, 524.
- The Premier Mine, by George Hanson. Trans. C.I.M.M., vol. XXV, 1922, pp. 225-232.
- The Dolly Varden Mine, by George Hanson. Trans. C.I.M.M., vol. XXV, 1922, pp. 212-220.
- The Portland Canal District, British Columbia, by George Hanson. High Commissioner, London.
- Post-Pleistocene Volcanics of the British Columbia Coast, by Victor Dolmage. Journal of Geology, vol. XXXII, No. 1, Jan.-Feb., 1924, p. 36.
- Origin of the Placer Gold of the Barkerville Area, Cariboo District, B.C., Canada, by W. L. Uglow and W. A. Johnston. Economic Geology, vol. XVIII, No. 6, Sept. 1923.
- Placers in Cobalt Conglomerate, by W. A. Johnston. Canadian Mining Journal, vol. XLV, Jan. 11, 1924.
- Placer Mines of Cariboo, B.C., Canada, by W. A. Johnston. High Commissioner, London.
- The Iron Ores of British Columbia, by G. A. Young. Ibid.
- Proposals Regarding a Time-scale for the Pre-Cambrian, by G. A. Young. Proc. and Trans. Royal Society of Canada, 3rd ser., vol. XVII, sec. iv, 1923, p. 45.
- Influence of Temperature on Colour and Lamination in Sediments, by E. M. Kindle. Report National Research Council, Rept. Committee on Sedimentation, Washington, 1924, pp. 40-42.
- The Terraces of the Lake Melville District, by E. M. Kindle. Geographical Review, vol. XIV, No. 4, Oct. 1924, pp. 597-602.
- A Bibliography of Ripple-mark, by E. M. Kindle (in collaboration with E. M. Edwards). Pan-American Geologist, vol. XLI, No. 3, Apr. 1, 1924, pp. 191-203.
- Notes on Mud-crack and Ripple-mark in Recent Calcareous Sediments, by E. M. Kindle. Journal of Geology, vol. XXXI, No. 2, Feb.-Mar., 1923, pp. 138-145.
- Note on Mud-crack and Associated Joint Structure, by E. M. Kindle. American Journal of Science, vol. V, Apr. 1, 1923, pp. 329-330.
- Nomenclature and Genetic Relations of Certain Calcareous Rocks, by E. M. Kindle. Pan-American Geologist, vol. XXXIX, June, 1923, pp. 365-372.
- Range and Distribution of Certain Types of Canadian Pleistocene Concretions, by E. M. Kindle. Bull. Geol. Soc. Amer., vol. 34, 1923, pp. 609-648.
- The Physical and Biological Characteristics of Certain Types of Marlyte Balls from Manitoba and Michigan, by E. M. Kindle. Trans. Royal Society of Canada, 3rd ser., vol. XVII, sec. IV, 1923, pp. 105-114.
- Silurian; A Review, by E. M. Kindle. Journal of Geology, vol. XXXI, No. 8, Nov.-Dec. 1923, pp. 682-686.
- The Oil Situation and Prospects in Canada, by G. S. Hume. High Commissioner, London.
- The Wainwright Oil and Gas Area, by G. S. Hume. Canadian Mining Journal, vol. XLIV, No. 51, Dec. 21, 1923, p. 1001.
- Recent Developments in the Fort Norman Oil Area, by G. S. Hume. Canadian Mining Journal, vol. XLIV, No. 48, Nov. 30, 1923, pp. 939-940.
- A Kinderhook Fauna in the Mackenzie District, Canada, by G. S. Hume. American Journal of Science, vol. 6, July, 1923, pp. 48-52.
- Oil Developments in Canada During 1923, by G. S. Hume. Trans. A.I.M.E., April, 1924, p. 185.
- Oil prospects in Southern Alberta, by M. Y. Williams. Canadian Mining Journal, Nov. 30, 1923.
- Coal Reserves in the Palliser-Kananaskis Area, B.C., and Alberta, by J. R. Marshall. High Commissioner, London.
- Mining Possibilities in Port Arthur District, Ontario, by T. L. Tanton. Ibid.
- Gold Occurrence in Onaman River, Ontario, by T. L. Tanton. Ibid.
- Geology and Mineral Deposits of Hastings County, by M. E. Wilson. "Over the Hills of Hastings, 1923," Hastings County Council.
- Exploration for Gold in Northwestern Quebec, by H. C. Cooke. Canadian Mining Journal, vol. XLIV, May 25, 1923, p. 390.

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- The Quebec Gold Fields, by H. C. Cooke. Ibid, vol. XLIV, Apr. 13, 1923, p. 276.
- A Review of Recent Developments, by H. C. Cooke. Ibid, vol. XLV, Feb. 1, 1924, p. 110.
- Conditions in the Mineral Industry, by W. Malcolm. Industrial Canada, vol. XXIV, No. 9, Jan. 1924, pp. 132-134.
- Canada's Mineral Industry, by W. Malcolm. The Gazette, Montreal, Commercial and Financial Review of the year 1923, (supplement) Jan. 5, 1924, pp. 61-66.
- Economic Geology of Canada, 1922, by W. Malcolm. Canada Year Book, 1922-1923 (1924), pp. 20-24.
- Contributions to Economic Geology of Canada, 1923, by W. Malcolm. Canadian Mining Journal, vol. XLV, No. 1, Jan. 4, 1924, pp. 15-18.
- Coal Fields of Canada, by W. Malcolm. Canadian Magazine, vol. LXI, No. 1, May, 1923, pp. 3-10.
- Field Work of Geological Survey, by W. H. Collins. Canadian Mining Journal, vol. XLIV, No. 28, July 13, 1923, pp. 530-533.
- The Iron Ores of Canada, by W. H. Collins. Financial Post, Feb. 29, 1924, pp. 17 and 29.
- Topographic Maps, by E. E. Freeland. Canadian Mining Journal, vol. XLV, No. 12, 1924, pp. 274-275.
- Topographical Mapping and Its Relation to the Mining Industry, by A. C. T. Sheppard. Bulletin C.I.M.M., No. 132, Apr. 1923, p. 258.
- A Type of Athabaskan Relative, by E. Sapir. Inter. Journal of American Linguistics, vol. 2, 1923, pp. 136-142.
- The Phonetics of Haida, by E. Sapir. Ibid, pp. 143-158.
- The Algonkin Affinity of Yurok and Wiyot Kinship Terms, by E. Sapir. Journal de la Société des Américanistes de Paris, vol. XV, 1923, pp. 36-74.
- A Note on Sarcee Pottery, by E. Sapir. American Anthropologist, N.S., 1923, pp. 247-253.
- The Grammarian and His Language, by E. Sapir. The American Mercury, vol. 1, 1924, pp. 149-155.
- Text Analyses of Three Yana Dialects, by E. Sapir. University of California publication in American Archaeology and Ethnology, vol. 20, 1923, pp. 263-294.
- Two Chinese Folk-Tales, by E. Sapir. Journal of American Folk-Lore, 1923, pp. 23-30.
- Humour of the Chinese Folk, by E. Sapir. Ibid, pp. 31-35.
- Culture, Genuine and Spurious, by E. Sapir. American Journal of Sociology, 1924, pp. 401-429.
- Racial Superiority, by E. Sapir. The Menorah Journal, 1924, pp. 200-212.
- Personal Names among the Sarcee Indians, by E. Sapir. American Anthropologist, N.S., 1924, pp. 108-119.
- The Rival Whalers, a Nitinat Story (Nootka Text), by E. Sapir. Inter. Journal of American Linguistics, vol. 3, 1924, pp. 76-102.
- Indian Days in the Canadian Rockies, by C. M. Barbeau. The Macmillan Co. of Canada, 1923.
- The Gaspé Fisher-folk, by C. M. Barbeau. The Quebec Daily Telegraph, Christmas, 1923.
- Fort Simpson, on the West Coast, by C. M. Barbeau. Ann. Rept. of Canadian Historical Association, 1923, p. 84.
- The Salmon Run on the Upper Skeena, by C. M. Barbeau. Forest and Outdoors, March, 1924.
- An Artist among the Northwest Coast Indians, by C. M. Barbeau. Arts and Decoration, May, 1923.
- Les Chants populaires du Canada. Revue de l'Amérique latine, Feb. 1924.
- The Historic Site of Temlaham, Skeena River, by C. M. Barbeau. Parks Branch.
- Physical Characteristics of the Copper Eskimo, by D. Jenness. Report of the Canadian Arctic Expedition, 1913-18, vol. XII, pt. B.
- Eskimo Folk-lore, by D. Jenness. Ibid, vol. XII, pt. A.
- Eskimo String Figures, by D. Jenness. Ibid, vol. XII, pt. B; Journal of American Folk-lore, vol. 36, 1923, pp. 281-294.
- Two Monuments in Arctic Canada, by D. Jenness. Canadian Historical Association, Ann. Rept., 1923, pp. 72-75.
- Origin of the Copper Eskimos and Their Copper Culture, by D. Jenness. Geographical Review, vol. XIII, Oct. 1923, pp. 540-551.
- Certain Eye Designs on Archaeological Artifacts from North America, by W. J. Wintemberg. Trans Royal Society of Canada, 3rd ser., vol. XVII, 1923, pp. 57-69.
- Unusual Stone Artifacts from Ontario, by W. J. Wintemberg. Thirty-fourth Annual Archaeological Report, 1923, pp. 81-82.
- Cowry Shells from Archaeological Sites in Ontario, by W. J. Wintemberg. American Anthropologist, N.S., vol. 26, pp. 119-120.
- Where the Forest Ends, by F. W. Waugh. Forest and Outdoors, March 24, 1924, pp. 155-157.
- Some Uses of Birch-bark, by F. W. Waugh (Anishinabe). Rod and Gun in Canada, Sept. 23, 1923, pp. 234-235.
- Bear Grease Pomade, by F. W. Waugh (Anishinabe). Ibid, Oct. 23, 1923, p. 339.

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- Note on Pugnacity of Tree Swallows, by C. E. Johnson. *Canadian Field Naturalist*, vol. 37, Apr. 1923, p. 77.
- Sparrows Caught by Rats, by C. E. Johnson. *Ibid*, vol. 37, May, 1923, p. 97.
- White-breasted Nuthatch Using an Electric-light Pole as a Feeding Station, by C. E. Johnson. *Ibid*, vol. 37, May, 1923, p. 97.
- A Curious Halo (With donated drawing and cut to accompany), by C. E. Johnson. *Ibid*, vol. 37, May, 1923, p. 96.
- Contents of Great Horned Owls' Stomachs, by C. E. Johnson. *Ibid*, vol. 37, Sept. 1923, p. 118.
- Notes supplied to Mr. Hoyes Lloyd, The Birds of Ottawa, by C. E. Johnson. *Ibid*, vol. 37, Sept. 1923; Oct. 1923; Nov. 1923; vol. 38, Jan. 1924.
- Birds of Ottawa, Christmas Week, by Clyde L. Patch. *Ibid*, vol. 37, No. 1, Jan. 1923, p. 18.
- The Tiger Salamander at Ninette, Manitoba, by Clyde L. Patch and D. A. Stewart, M.D. *Ibid*, vol. 38, No. 5, May, 1924, p. 81.
- Magpies and Stock, by P. A. Taverner. *Canadian Field Naturalist*, vol. XXXVII, 1923, p. 77.
- Circumventing the House Sparrow, by P. A. Taverner. *Canadian Field Naturalist*, vol. XXXVII, 1923, pp. 137-138.
- Further Notes on the European Hare in Ontario, by R. M. Anderson, *Ibid*, vol. XXXVII, 1923, pp. 75-76.
- Range of the Moose Extending Northward, by R. M. Anderson. *Ibid*, vol. XXXVIII, 1924, pp. 27-29.
- Canada's Eastern Coal Fields, by J. McLeish. *Natural Resources*, vol. 2, Nov. 1923.
- Canada's Metallurgical Industries in Relation to Export Trade, by J. McLeish. *Canadian Export Pioneer*, vol. 5, April, 1924, p. 209.
- Recent Work of the Canadian Mines Department in Chemistry and Metallurgy, by J. McLeish. *Canadian Chemistry and Metallurgy*, vol. 8 (1924), pp. 111-113.
- Investigations of the Mines Branch, Department of Mines, by J. McLeish. *Canadian Mining Journal*, vol. XLIV (1923), pp. 552-554; vol. XLV (1924), pp. 662-664.
- Western Chemical Industries, by A. W. G. Wilson. *Natural Resources*, vol. 2, March, 1923.
- Marketing Molybdenum Products, by A. W. G. Wilson. *Engineering and Mining Journal Press*, vol. 116 (1923), p. 231.
- Precious Metals of Canada, by A. W. G. Wilson. *Canadian Mining Journal*, vol. XLV (1924), pp. 471-474, pp. 495-498.
- Fire-bricks from Saskatchewan Clays, by H. Fréchette. *Natural Resources*, vol. 2, July, 1923.
- Clay Products Situation Throughout Canada, by H. Fréchette. *Contract Record and Engineering Review* (1924), vol. 38, pp. 183-184.
- Notes on the Operation of Several Dressler Tunnel Kilns, by L. P. Collin. Papers given before the February Meeting of the Canadian Clay Products Association, Toronto, Ont., and published in the February issue of the Association Journal.
- Bituminous Sands of Northern Alberta, by S. C. Ells. *Canadian Mining Journal*, vol. XLV (1924), pp. 298-304, pp. 400-403; *National Petroleum News*, vol. 16, April 9, 1924, pp. 69-73; April 23, 1924, pp. 75-82. High Commissioner, London.
- The Metallurgical Industry, by W. B. Timm. *Industrial Canada*, Annual Review Number—January issue.
- Non-Metallic Minerals and Chemicals Used in the Pulp and Paper Industries, by L. H. Cole. *Pulp and Paper Magazine*, Jan. 1924, pp. 115-125; *Canadian Mining Journal*, vol. XLV (1924), pp. 158-160, pp. 236-239, pp. 258-261.
- Magnesium Sulphate and Sodium Carbonate of Western Canada, by L. H. Cole. High Commissioner, London.
- Silica in Canada, by L. H. Cole, *Ibid*.
- Sodium Sulphate in Western Canada, by L. H. Cole. *Ibid*.
- Sodium and Magnesium Salts of Western Canada, by L. H. Cole. *Bulletin of the Canadian Institute of Mining and Metallurgy*, March, 1924, pp. 100-128.
- Canada Possesses Non-metallics of Great Richness, by H. S. Spence. *Financial Post*, vol. 17, No. 17, Apr. 27, 1923.
- Canada Has Important Feldspar Resources, by H. S. Spence. High Commissioner, London.
- An addition to the Mineral Resources of Western Canada—Bentonite or Colloidal Clay, by H. S. Spence. *Ibid*.
- Mining in the Slocan Division, British Columbia, in 1923, by A. H. A. Robinson. *Ibid*.
- Recent Mining Developments in East Kootenay, B.C., by A. H. A. Robinson. *Ibid*.
- Review of the Mining Industry in Canada, 1923, by A. H. A. Robinson. Imperial Mineral Resources Bureau. Statement sent each year.
- Information regarding Canadian Metals and Minerals for the Imperial Economic Conference, by A. H. A. Robinson. For Dr. Chas. Camsell, Deputy Minister.
- Canada Has Numerous Deposits of Molybdenum Ore, by V. L. Eardley-Wilmot. High Commissioner, London.

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Canadian Diatomaceous Earth, by V. L. Eardley-Wilmot. Ibid.
Garnets Now Being Mined in Canada, by V. L. Eardley-Wilmot. Ibid.
The Manufacture of Carbon Black in Canada, by R. T. Elworthy. Ibid.
Canadian Helium for Airships, by R. T. Elworthy. Ibid.
Recent Developments in the Use of Canadian Fuels, by B. F. Haanel. Pulp and Paper Magazine, vol. 22, January, 1924, pp. 82-85.
The Fuel Resources of Canada and Their Utilization for the Production of Power and other Purposes, by B. F. Haanel. Prepared for the World Power Conference in England, 1924.

The following papers were prepared and presented by the Deputy Minister:

(1) "The Fuel Problem, A Review of the Fuel Situation in Canada, the Problems, and Progress towards a Solution," delivered at the annual meeting of the Engineering Institute of Canada held in Ottawa in January, 1924.

(2) "The Mineral Industries, Their Present Place in the Commercial Development of Canada," delivered at the annual meeting of the Canadian Institute of Mining and Metallurgy held in Toronto in March, 1924.

In the Department's work of advertising and circulating information with respect to our mineral resources there has been active co-operation on the part of the National Resources Intelligence Service of the Department of the Interior in the preparation by that branch of a number of articles mainly for circulation in the daily or weekly press.

Although the functions of the Explosives Division cover the administration of the Explosives Act under which the manufacture, testing, storage, and importation of explosives are regulated, the number of preventable accidents due to careless handling of explosives is such that it was considered necessary to circulate among the general public information regarding the proper handling of such explosives. Two pamphlets were, therefore, prepared entitled "Explosives—Warning" and "The Handling of Explosives," and were given as wide circulation as possible.

Reference has been made in previous annual reports to the valuable work being carried on by the staff of the Museum, and the handicaps with which we are faced owing mainly to lack of adequate space in which to exhibit the material that has been, and can be, collected. The collections and exhibits are year by year attracting larger numbers of visitors, but there is still a great deal of interesting material stored away which cannot be put on exhibition owing to lack of space. It has been said that the degree of civilization to which any nation has attained is best shown by its public museums and the liberality with which they are maintained, and Canada cannot have a National Museum worthy of the Dominion until there is a greater public appreciation of this fact, and a realization that museums properly supported and conducted have a real educational value and are essential in scientific progress. The housing of the staff of the Geological Survey makes for congestion in the Victoria Memorial Museum, and until other quarters are found for the Geological Survey, the development of a National Museum cannot be properly proceeded with.

Under the auspices of the Museum, courses of lectures throughout the winter were again held in the lecture hall, and the staff have filled engagements at many outside points. As in previous years the lectures were well attended, particularly those for children. These in many cases had to be repeated three times on Saturday mornings in order to accommodate the crowds of children waiting to hear them. As in previous years the Museum staff drew largely on the staff of the Geological Survey for lecturers, but in 1923 lecturers were also provided by the Dominion Parks Branch of the Interior Department, and moving pictures were supplied by the Department of Trade and Commerce.

The Dominion Fuel Board which was created in November, 1922, under the chairmanship of the Deputy Minister of Mines, continued its work in 1923 and

a great deal of the time of the Deputy Minister was devoted to the work of the Board. An interim report was issued in the spring of 1923, which included a statement of the broad facts of Canada's past and present situation in regard to fuel supplies, coupled with a review of the methods then advanced for strengthening that position, and of investigations planned by the Board to ascertain the practical value of every source of permanent relief. A number of investigations were put in hand with the co-operation of the Mines Branch and Geological Survey of this Department, and the Forestry, Water Powers, and Natural Resources Intelligence Branches of the Interior Department. After a survey of the situation the Board was convinced that the most urgent need of our whole fuel situation was the provision of a satisfactory domestic fuel for the provinces of Ontario and Quebec which had become dependent on foreign coals for a fuel of this nature. It appeared to the Board that domestic coke made in by-product recovery ovens offered the most satisfactory substitute for anthracite, and an investigation was, therefore, made by an engineer of the board to determine at what points and to what extent by-product coke plants could be established to produce this fuel. The erecting of by-product ovens and the use of the coke produced would undoubtedly go far towards solving our domestic fuel problems and in addition would be, perhaps, the most important factor in stabilizing the coal-mining industry of the Maritime Provinces by creating a large and steady market for the output of the mines of those provinces. Other investigations being undertaken by the board include: (1) the use of wood as an auxiliary fuel in Ontario and Quebec; (2) central and district heating; (3) house construction and insulations; (4) the higher grade fuel areas of Alberta; (5) a review of the coal reserves of Nova Scotia.

The Joint Peat Committee which was engaged in carrying out experimental work in connexion with the manufacture of peat fuel was disbanded at the close of the fiscal year 1922-23 and no further work on the bog at Alfred was undertaken by either the Dominion or Ontario Governments. The machinery remaining on the bog was disposed of to a company, Peat Fuels, Limited, which proposes to remodel the plant, operate it by electrical power, and manufacture peat fuel on a commercial scale.

In addition to his duties in connexion with the administration of the Department, the Deputy Minister continued to devote part of his time to other duties falling upon him by reason of his occupying the following positions, namely: Chairman, Dominion Fuel Board; Chairman, Advisory Committee on Mining Regulations; Member of the Council of the Northwest Territories. He was called upon in January to act as Chairman of the Canadian National Committee to prepare for participation in the first World Power Conference which was to be held in London June 30 to July 12, 1924. He also acted as one of the official Canadian delegation at the Imperial Economic Conference which was held in London during October and November.

The item on the agenda of the Imperial Economic Conference with which the Department of Mines was more directly concerned, was that dealing with co-operation in technical research and information. Under this item the question of the future of the Imperial Institute and its relation to the Imperial Mineral Resources Bureau was discussed. The committee dealing with the subject, on which the Deputy Minister represented Canada, recommended to the Conference that the Imperial Institute be reorganized, that the Imperial Mineral Resources be amalgamated with it, and that the exhibition galleries of the Institute be no longer maintained. The committee also recommended that since Great Britain was prepared to make an annual grant of £9,000 and the colonies and protectorates an annual grant of £8,000 for a period of five years, the Dominions and India together should contribute £8,000 annually for five years, Canada's contribution being fixed at £2,000. Both these

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recommendations were approved by the Conference. After the adjournment of the Conference, however, circumstances arose which made it possible to continue the maintenance of the exhibition galleries, and Canada was asked to contribute an additional £1,040 a year for this purpose. A sum equivalent to £3,040 was, therefore, provided in the estimates of the Department of Mines for the year 1924-25 to cover these commitments.

Owing to the apparent gradual exhaustion of the oil fields of southern Ontario and the possibility of applying other methods of recovery than that at present in use, the Deputy Minister was instructed to visit and report on the oil fields of Alsace in France, and those of Hanover in Germany, where, after these fields had been almost exhausted by pumping, an increased production was obtained by sinking shafts and driving galleries into the oil sands. This investigation was made during the month of September and on the Deputy's return to Canada a report was issued in collaboration with Mr. A. Buisson of the Mines Branch, entitled "Recovery of Petroleum by Shafts and Galleries at Pechelbronn, Alsace, and at Wietze, Hanover, Germany."

The Department has continued its plan of co-operation with other organizations throughout Canada, both provincial and federal, engaged in the development or administration of mineral resources. Contact has been maintained with similar organizations in the Federal Service of the United States, and with the Department of Scientific and Industrial Research in England, to the advantage of ourselves and, we trust, of the organizations mentioned. Arrangements were also completed with the Canadian National railways whereby geological investigations are carried on in territory tributary to the railway system, with the object of stimulating development of such mineral resources as might provide tonnage to the railways.

A representative of the Department was assigned to participate in the tour of the Canadian Exhibition train in France from July to November, 1923. Special exhibits and reports were prepared for Canada's participation in the British Empire Exhibition at Wembley and arrangements were made with the Department of Immigration that two of our best qualified officers should be assigned to that Department during the life of the Exhibition to supply information at Wembley regarding the mineral resources of Canada.

The mining industry showed very satisfactory progress during the year 1923. In that year we produced minerals to the value of \$214,000,000. Compared with the production ten years ago this indicates an increase of 66 per cent. Because of the dependence of modern civilization on mineral products, it can safely be said that Canada will be producing and using more mineral products ten years hence than she does now. No forecast can be more confidently made than this.

Mineral products are essential to modern civilization, and as that civilization advances and becomes more diversified the position of the mining industry becomes more important. To appreciate the dependence of modern civilization on the mining industry one has only to consider the condition of the world if production of coal, oil, iron, and the other metals were to cease. Such a thought brings home to us the fact that the mining industry is the very bedrock and foundation of modern civilization. It is a basic industry without which most of the other industries could not be carried on.

In Canada, mining is only on the eve of its development and because of the peculiar physical, geological, and natural conditions of our country, mining is destined to occupy a relatively larger place in our economic development than in any other country in the world.

Only when we realize two points, namely, the importance of the mining industry in modern civilization and the enormous extent of our known and potential mineral resources, will we realize how fortunately we have been

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endowed by nature, the responsibilities and advantages that have fallen to us, and the place that we must ultimately occupy among the nations of the earth.

Modern civilization, however, makes a terrific drain on mineral reserves. In spite of popular notions to the contrary mineral reserves are limited and a mine produces only one crop. Older countries are gradually exhausting these reserves, and are being compelled to work lower-grade deposits or to seek for supplies in the newer countries where the higher-grade deposits are not yet exhausted. Herein lies Canada's opportunity. Her known wealth in mineral resources is great, but her potential wealth is greater still. Her mineral industries have successfully passed through the period of depression following the war, and have gathered new momentum. Great areas of virgin territory are as yet unprospected. Each year sees new discoveries and new developments in this virgin territory, and it is safe to say that we have potential resources of minerals that are capable of supplying the requirements not only of our own country but of those countries less fortunately endowed by nature with minerals.

Our mineral trade with foreign countries, however, is not as satisfactory as it should be. In raw minerals we are importing about \$70,000,000 worth more than we export, though in partly manufactured minerals such as refined metals we have a favourable trade balance of about \$20,000,000. It is in the fully manufactured materials of mineral origin that our condition is most unsatisfactory, the balance being about \$150,000,000 worth against us annually. Heavy importations of coal, oil, and iron ore are the cause of our unfavourable position with respect to the raw materials, and in manufactured materials our condition emphasizes the necessity of establishing such industries as will take the products of our mines and convert them into finished articles, at least for our own consumption, rather than to export the raw materials for manufacture outside the country and later importation in the finished state.

Your obedient servant,

CHARLES CAMSELL,
Deputy Minister.

GEOLOGICAL SURVEY

W. H. Collins, Director

ORGANIZATION AND CHANGES IN STAFF

A statement of the organization was given in a chart accompanying the Annual Report, 1923, and further information regarding the units comprising the Geological Survey can be obtained from the Annual Report for the year ending March 31, 1921.

B. R. MacKay was appointed as geologist, M. E. Hurst and W. F. James as assistant geologists, H. N. Spence, J. W. Spence, and J. V. Butterworth as junior topographical engineers, and M. L. Barrett as library assistant. E. Poitevin was promoted from the position of associate mineralogist to chief of the Division of Mineralogy.

The British Columbia branch office, maintained at rooms 509-512 Pacific Building, Vancouver, is under the present direction of V. Dolmage. During the year a large number of callers seeking information were received. In addition to these personal interviews many reports and maps were sent to interested parties in British Columbia and United States. The work and usefulness of this branch office have steadily increased since its establishment.

The Survey sustained a severe loss through the death of Joseph Keele who had rendered good service by his work on clays and shales. M. F. Bancroft resigned to accept a position at Acadia University and C. H. Freeman, junior topographical engineer, was transferred to the Mines Branch.

GEOLOGICAL FIELD WORK

Forty parties carried on field work in various parts of Canada during the summer of 1923. A brief statement of the work of each party follows.

British Columbia and Yukon

W. E. Cockfield spent part of the field season in an investigation of the ore deposits of Keno Hill area, Mayo district. A brief examination was also made of the newly discovered silver-lead deposits of Beaver River area, about 80 miles northwest of Mayo. Reports on these investigations are published in the Summary Report of the Geological Survey for 1923, Part A. The geographical and geological mapping of the area around Whitehorse in southern Yukon, begun in 1922, was also carried on. During Mr. Cockfield's absence in northern Yukon the work in the southern part was continued by H. H. Bell. A small part of the work in this area remains unfinished.

George Hanson completed a geological reconnaissance of the eastern margin of the Coast Range batholith between Portland Canal district and the Canadian National railway. A full account of this work is given in the Summary Report, Part A. While in this area he made a collection of ore specimens, and smelter and mill products, for the British Empire Exhibition, to represent Portland Canal and Alice Arm districts.

Victor Dolmage completed an investigation of the Allenby Mountain ore deposits near Allenby, and made a detailed geological map of the area, which comprises 20 square miles. Two deposits of talc near mile 175 on the Pacific and Great Eastern railway were also examined.

T. B. Williams made an investigation of the northern part of the Nanaimo coal basin, on the east side of Vancouver island. In 1921 the late J. D. Mackenzie began an investigation of the coal deposits of this area and completed the work in 1922, but owing to his sudden death in December, 1922, the maps and reports which were in course of preparation could not be completed. Accordingly, Mr. Williams was entrusted with the task of finishing the investigation, and preparing the maps and report, after spending the field season of 1923 in reviewing the geology of the area previously examined by Mr. Mackenzie.

C. E. Cairnes continued his geological investigations in southwestern British Columbia between the towns of Hope and Princeton, by exploring the territory north of the International Boundary, drained by parts of Silver creek, Klesilkwa and Skagit rivers. A full report covering the general and economic geology of this region is given in the Summary Report, Part A. A geological map accompanies the report.

M. F. Bancroft and J. F. Walker made a geological examination of the Windermere map-area in southeastern British Columbia. The area comprises 700 square miles and lies near Invermere on the Kootenay Central branch of the Canadian Pacific railway between Golden and Cranbrook. It contains gold deposits, and its geology is an essential link in the geological mapping of southeastern British Columbia. It is expected that the field work will be completed by Mr. Walker in 1924.

G. A. Young continued a detailed investigation of the iron ore resources of British Columbia commenced in 1922. Various deposits on Queen Charlotte islands, along the Pacific coast of the province, in the vicinity of Harrison lake and Kamloops, were examined, mapped, and otherwise studied in such detail as circumstances warranted. It is expected that the general investigation will be completed in 1924.

W. A. Johnston completed the investigation of the placers of the Barkerville area, Cariboo district. Interest in the Cariboo placers has been quickened by the starting of gold-dredging operations in the Barkerville area, and other developments have ensured the continuance of placer mining for some years to come.

Northwest Territories

The investigation, commenced in 1921, of the petroleum and other mineral-bearing possibilities of Mackenzie basin, was continued in 1923 by G. S. Hume. The geology along Little Bear river was studied and mapped. A survey and examination of the Brackett River-Whitefish Lake area and a geological reconnaissance along the Mackenzie from Carcajou river to Good Hope were also made. A sub-party under W. A. Kelly investigated the Dahadinni-Redstone Rivers area on the west side of the Mackenzie. A report giving the general results of the work is published in the Summary Report, Part B.

Alberta

Since 1916 it has been known that coal beds of good quality and workable thickness exist in the neighbourhood of Brûlé lake in Jasper park, and extend northwest to Smoky river, but little more was known about them. John MacVicar spent the summer of 1916 in examining this area and the summer of 1919 in an adjacent coal area to the east. The results of this preliminary work are given in the Summary Report, Part B.

D. B. Dowling made an examination of the Bow River coal basin within the Rocky mountains, with a view especially of determining whether the basin contains coal seams of the better grades of domestic coal, that are less fractured and, therefore, better suited for producing non-friable coal, than those

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already mined. The results of the investigation and a general account of the coal areas along the main line of the Canadian Pacific railway are given in the Summary Report, Part B.

John Marshall completed the geological mapping of the Palliser-Kananaskis map-area. The final report covering the entire area, accompanied by a geological map on a scale of 2 miles to 1 inch, is in course of preparation.

E. J. Whittaker and M. Y. Williams continued a systematic re-survey of the geological succession, structure, and mineral resources of an area in southern Alberta and adjacent parts of Saskatchewan and British Columbia, extending from the International Boundary north of latitude 52 degrees and from longitude 109 degrees west to 115 degrees 30 minutes. Of this territory Dr. Williams surveyed a strip 48 miles wide extending from the Saskatchewan boundary westward to beyond Lethbridge. Mr. Whittaker surveyed a similar strip adjacent on the north. It is proposed to continue this investigation in 1924.

P. S. Warren, at the request of the Director of the Parks Branch, Department of the Interior, made an investigation of the hot springs near Banff, Alberta. Of late years the flow of the upper hot spring has been increasingly irregular and intermittent, and an opinion was desired as to whether measures could be taken to restore and maintain the flow. A report has been rendered to the Director of the Parks Branch in which the opinion was advanced that the springs are fed from the surface, that the irregular flow has been due to abnormal meteorological conditions during the past few years, and that remedial operations will probably prove to be unnecessary. Concurrently with this investigation a detailed geological survey of about 50 square miles of the surrounding country was made.

G. S. Hume made an investigation of the clay deposits along Athabaska river. The clays are Cretaceous and some of them are semi-refractory, but as a rule they have considerable overburden. A full report on the deposits is given in the Summary Report, Part B.

C. M. Sternberg continued the collecting of vertebrate fossils from the Edmonton formation in the Red Deer valley above Drumheller, Alberta, and discovered five valuable dinosaur specimens. A reported occurrence of vertebrate fossils in Jasper park was also examined, but with negative results.

E. M. Kindle spent six weeks of the season in the Rocky mountains of British Columbia and Alberta for the purpose of assisting in determining the geological succession in the Windermere, Banff, and Kananaskis map-areas which were being examined by M. F. Bancroft, P. S. Warren, and John Marshall.

Saskatchewan and Manitoba

J. S. DeLury commenced a geological survey of an area of Precambrian schists, north and east of La-Ronge, Saskatchewan. This area is geologically similar to others in northern Manitoba, Ontario, and Quebec, and is believed to be favourable for the occurrence of mineral deposits. It is expected that this survey will be completed in 1924.

J. F. Wright extended the detailed mapping of the Rice Lake gold area, begun in 1922, southeast to the Manitoba-Ontario boundary. The area examined in 1923 is called Beresford Lake map-area. A preliminary map and report on the northern part are published in the Summary Report, Part B.

Ontario

T. L. Tanton completed the geological mapping of an area which embraces the cities of Fort William and Port Arthur, Thunder Bay district. A com-

plete report on the area, accompanied by maps, is being prepared. Mr. Tanton also examined an iron occurrence at Gravel lake, and other mineral prospects outside the area. A report on the iron occurrence is given in Summary Report, Part C I.

Ellis Thomson commenced a geological survey of an area of 400 square miles immediately northeast of Woman river, on the main line of the Canadian Pacific railway, and bounded by latitudes $47^{\circ} 30'$ and $47^{\circ} 45'$ and longitudes 82° and $82^{\circ} 30'$. The area is underlain by Precambrian schists favourable to the occurrence of mineral deposits, and contains several iron ranges carrying low-grade iron ore and pyrite. It is expected that this work will be continued in 1924.

R. C. Emmons made a geological survey of an area of 150 square miles lying east of Echo lake near Sault Ste. Marie. The area is underlain by Huronian sedimentary formations, the study of which is important for an understanding of the geology of northeastern Ontario. It contains deposits of copper and gold ores of minor importance. The results will be embodied in a forthcoming memoir on the north shore of lake Huron.

G. W. Bain mapped in detail an area of about 150 square miles north of Webbwood. The area contains a considerable body of norite similar in composition to the nickel-copper bearing norite of Sudbury district. It is also of considerable scientific interest in connexion with the study of the Precambrian geology of northeastern Ontario.

T. T. Quirke commenced a detailed geological survey of an area of approximately 400 square miles situated on the north coast of Georgian bay near Killarney. This area is mostly underlain by granite with which are associated pegmatite dykes containing feldspar, mica, and other pegmatitic minerals of possible economic importance. In the same vicinity are quartzites of sufficient purity to be used for various manufacturing purposes. Owing to the location of the area on Georgian bay and the consequent cheap transportation facilities to Canadian and United States markets on the Great Lakes, these minerals are most favourably situated for development. The area lies between the Huronian region of northern Ontario and the Grenville region of eastern Ontario, and is, therefore, of much interest in connexion with the geological correlation of these two regions. It is expected work will be continued in 1924.

E. M. Kindle spent two months of the season in studying the stratigraphy of the James Bay region as developed along Abitibi, Moose, and Missinaibi rivers. A report giving the main results of the work is published in the Summary Report, Part C I.

H. V. Ellsworth made an investigation of the radioactive minerals of north Hastings county. The results are published in the Summary Report, Part C I. Mr. Ellsworth was also engaged in an investigation of the beryllium-bearing minerals in the provinces of Ontario and Quebec. Beryllium is a white, very light metal, two-thirds as heavy as aluminum, and with a much higher melting point. The recognition of the uses to which a light and resistant metal may be put warranted an inquiry into the probable resources of beryllium in Canada. A report embodying the results of the investigation is in course of preparation.

M. E. Wilson continued the systematic geological survey of mineral areas in southeastern Ontario and southwestern Quebec, begun by the Geological Survey 11 years ago. He examined parts of the Madoc and Marmora map-areas, and also a copper deposit in Petite Nation Seigniory, Papineau county, Quebec, a report on which is given in the Summary Report Part C I. It is expected that the mapping of the Madoc and Marmora areas will be completed in 1924.

Ernst Antevs, of the University of Stockholm, studied the recession of the last ice-sheet of the Glacial period from the Great Lakes to James bay by means

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of the seasonally banded clays deposited in glacial lakes and in arms of the sea as the ice-sheet gradually withdrew. Mr. Antevs' work in Canada was a continuation of his investigations, in 1922, of the retreat of the ice-sheet in New England. The investigation is of considerable scientific and popular interest as it is an attempt to determine, by actually counting the annual layers of clay, the time that elapsed during the retreat of the ice and since its disappearance.

Quebec

The detailed geological mapping of prospective gold areas in Quebec adjacent to the well-known gold-producing areas of northern Ontario, which was begun in 1922, was carried on in 1923 by three parties.

H. C. Cooke examined a number of gold deposits in western Quebec, chiefly from the standpoint of genesis of the ore. He examined the Argonaut gold mine, Ontario, and investigated the recent gold discoveries at Larder lake, Ontario. Reports on these investigations are given in the Summary Report, Part C I.

W. F. James made a detailed geological investigation of the Rouyn map-area, Timiskaming county, Quebec, an area to which the attention of prospectors and mining men is being particularly directed. A preliminary map and report are published in the Summary Report, Part C I.

Robert Harvie examined the Dufresnoy Lake map-area adjacent to Rouyn area. His report is given in the Summary Report, Part C I.

F. A. Kerr commenced a detailed geological survey of the Coaticook map-area, east of lake Memphremagog. The area contains important quarries, and molybdenum is known to occur in the vicinity. It is expected that the work will be continued in 1924.

J. B. Mawdsley investigated an area north of Baie St. Paul, on the north shore of St. Lawrence river. The area contains a large body of basic igneous rock called anorthosite, associated with which are numerous deposits of titanium-bearing iron ore.

F. J. Alcock continued the geological mapping of an area in the central part of Gaspé peninsula around mount Albert. This work was begun in 1921, but only topographic mapping was done in 1922. A part of another season will be required to complete the work. Mr. Alcock also examined two copper deposits in Gaspé, one near Matane and the other on the headwaters of York river. A report on these deposits appears in Part C II of the Summary Report.

Miss J. D. Dart, with the assistance of Professor Charles Schuchert of Yale University, investigated the stratigraphy and palaeontology of the Palaeozoic rocks between Port Daniel and Newport on the south side of Gaspé peninsula.

A. T. McKinnon collected, in Ontario and Quebec, minerals for exhibition purposes and for use in the preparation of educational collections.

New Brunswick and Nova Scotia

W. S. Dyer geologically mapped and studied that part of the Minto coal basin of New Brunswick covered by the Minto and Chipman map-areas, each embracing about 200 square miles. The topographical map of the Chipman area is not yet completed.

A. Anrep investigated and surveyed the Maugerville, Escuminac, Eel, Shippigan, Pokemouche, Shippigan Island (Lamek), and Miscou peat bogs. A full report illustrated with plans of the bogs appears in the Summary Report, Part C II.

W. A. Bell continued his investigation of the Pictou coal area, Nova Scotia, and made an examination of certain small coal seams at Sydney, Cape Breton. A trip was also made to Madame island, C.B., to advise on the prospects for

coal there. The examination of some drill-cores from the Pictou coal field furnished important data regarding the oil-shales. A report on them, as well as on the correlation of the coal seams at North Sydney and the prospects for coal at Madame island, are given in the Summary Report, Part C II. Mr. Bell also made a study of the flora of the Minto coal horizon in New Brunswick for the purpose of correlating the coal horizons in Nova Scotia and New Brunswick. A report on the correlation of the Minto coal horizon appears in Part C II of the Summary Report.

E. R. Faribault continued a systematic geological and geographical survey, on the scale of 1 mile to 1 inch, of the northern part of Annapolis county, Nova Scotia. A detailed structural map of the Nictaux, Torbrook, and Inglesville iron ranges in the Middleton and Paradise areas was also completed.

M. E. Hurst examined a number of arsenopyrite deposits in Nova Scotia, New Brunswick, and Ontario for a report on the arsenic resources of Canada.

TOPOGRAPHICAL DIVISION

W. H. Boyd, Chief Topographical Engineer, reports as follows:

During the year C. H. Freeman was transferred to the Mines Branch, Department of Mines. J. W. Spence, J. V. Butterworth, and H. N. Spence were appointed as junior topographical engineers.

FIELD WORK

Topographical and geographical surveys, to meet the requirements of the Geological Survey, were carried on during the field season in British Columbia, Manitoba, Ontario, Quebec, and Nova Scotia.

British Columbia

A. C. T. Sheppard was engaged in the topographical survey of Kokanee Park reserve, West Kootenay, B.C. This work was undertaken at the request of the Minister of Mines, B.C., and the Nelson Board of Trade. As the greater part of the Park reserve is included in the standard sheet, between latitudes $49^{\circ}45'$ and $50^{\circ}00'$, longitudes $117^{\circ}00'$ and $117^{\circ}15'$, which the Geological Survey had planned to survey for their own requirements; and as the survey of all the Park Reserve could be carried out at the same time as the surveys of the Topographical Division in the area, with very little additional expense, the complete topographical surveying of the Park reserve was consequently undertaken and was completed. During the progress of the work close co-operation with the British Columbia Department of Lands was maintained and much information required by them was obtained by the Geological Survey party in the field. The map of Kokanee Park Reserve will be published on the scale of 1 inch to $\frac{1}{2}$ mile with a contour interval of 100 feet. Progress was also made on the remainder of the standard 1-mile sheet.

J. A. Macdonald assisted Mr. Sheppard in the work.

W. H. Miller completed the standard 1-mile sheet included between latitudes $54^{\circ}45'$ and $55^{\circ}00'$, longitudes $126^{\circ}45'$ and $127^{\circ}00'$. This sheet includes the various mineral properties in Babine mountains directly east of Smithers, B.C. The contour interval used is 100 feet.

Manitoba

R. C. McDonald carried out the control surveys for geographical map sheets in northern Manitoba. The route surveyed was as follows: starting at the 15th base-line on Playgreen lake, the east channel of Nelson river was fol-

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lowed down to the crossing of the principal meridian, thence up Echimamish river to the divide and down to Oxford lake. From Oxford lake a new route was surveyed to Nelson river via Clearwater lake and river. The survey was then carried up Nelson river, through Sipiwesk lake, Cross lake, and Pipestone lake to Echimamish river. About 1,067 miles of subtense traverse was run and about 2,150 miles of shoreline was surveyed. The survey was connected to all crossings of land-lines and wooden reference posts were left at many points along the whole route. Throughout all this work a specially constructed radio receiving set was carried for receiving the various time signals broadcast from different stations. These time signals were used in connexion with observations made for latitude, longitude, and azimuth.

Ontario

S. C. McLean carried out the triangulation control for the geographical surveys in the country between Penache lake and Georgian bay, Ontario. This work was a continuation of the triangulation net carried out in Sudbury region, by this division, in 1915. The geographical positions of all the stations are based on the position of the astronomical station, established in 1900 by the Dominion Observatory, at Rayside, on the Canadian Pacific railway. The triangulation was carried to Georgian bay. The lighthouse at Killarney is the most southerly established point. Connexion was made to several points on the lakes in the area, in order to give many points of control for the lake surveys. Mr. McLean acknowledges the co-operation and generous assistance in the field of the officers and rangers of the Forestry Branch, Department of Lands and Forests, Ontario, operating in the Sudbury district.

E. E. Freeland completed the topographical surveys, commenced last year, for the three standard 1-mile sheets included between latitudes $48^{\circ} 15'$ and $48^{\circ} 30'$, longitudes $88^{\circ} 45'$ and $89^{\circ} 30'$. These sheets include the cities of Fort William and Port Arthur.

Mr. Freeland also completed a main traverse control survey along the main line of the Canadian Pacific railway between Nipigon and Port Arthur. This traverse, which is for the purpose of controlling a series of geographical sheets for geological requirements, is connected to a geodetic survey station near Port Arthur, to the astronomical station established by the Dominion Observatory at Nipigon, and to some of the Hydrographic Survey stations in the vicinity.

Mr. Freeland also spent two weeks, with Mr. Boyd, in the Missinaibi area, where a triangulation control was made of Dog lake. This control was for the purpose of connecting various surveys and of establishing some fixed points for the geographical map of the area.

Quebec

K. G. Chipman completed the topographical surveys, commenced last year, in the Gaspé district, Que., for the standard 1-mile sheet included between latitudes $48^{\circ} 45'$ and $49^{\circ} 00'$, longitudes $66^{\circ} 00'$ and $66^{\circ} 15'$. This sheet includes the Federal Lead and Zinc mine.

Mr. Chipman also completed the topographical surveys for the standard 1-mile sheet in the vicinity of East Broughton. This sheet is included between latitudes $46^{\circ} 00'$ and $46^{\circ} 15'$, longitudes $71^{\circ} 00'$ and $71^{\circ} 15'$. The contour interval is 50 feet. In connexion with the surveying of this sheet, co-operation was maintained with the Militia Service, Department of National Defence. Their surveys division had completed a network of road surveys, with elevations, for the control of their proposed map which included this area. The plans and data for these surveys were supplied to this Department and were used in conjunction with the surveys of the Geological Survey for this sheet.

In return, a copy of the completed map was supplied to the Surveys Division, Militia Service, for their information and use.

Mr. Chipman unfortunately contracted typhoid fever during the completion of the work in the East Broughton area, but, although quite ill, had the work satisfactorily completed before he went into hospital.

J. W. Spence assisted Mr. Chipman in the work in Gaspé and East Broughton.

R. Bartlett carried out the main control traverse surveys of waterways in Rouyn district, Quebec. These surveys, which are for the control of geographical map sheets, required for geological purposes, were carried along the routes not being surveyed by the Department of Lands and Forests, Quebec. Connexion, however, was made to posts which were established by their surveys. The surveys were completed for the 1-mile sheets included between latitudes $48^{\circ} 00'$ and $48^{\circ} 30'$, longitudes $78^{\circ} 30'$ and $79^{\circ} 00'$. Through the courtesy of Mr. D. W. Mill, Director of Surveys, Department of Lands and Forests, Quebec, much information relating to the proposed work of their Department, in the area, together with plans of the completed surveys of the townships and waterways, was furnished the division. Acknowledgment is made of the valuable assistance rendered in this way.

Nova Scotia

A. G. Haultain completed the topographical surveys for the standard 1-mile sheet included between latitudes $46^{\circ} 30'$ and $46^{\circ} 35'$, longitudes $64^{\circ} 00'$ and $64^{\circ} 15'$. The contour interval used was 50 feet. This sheet includes the coal mining area and town of Springhill, N.S.

Mr. Haultain also completed a detail topographical map on the scale of 1 inch to 400 feet with 10-foot contours, of an area of about 1 square mile around the coal mines at Springhill. This detail map is for the purpose of detail geological study as well as for assisting the coal mining operations.

J. V. Butterworth assisted Mr. Haultain in all of the work.

S. C. McLean, at the conclusion of the control work in Ontario, carried out the main traverse control for topographical surveys in Kings and Annapolis counties, Nova Scotia. These main control surveys, which are connected to the Geodetic Survey stations "Aylesford" and "Annapolis", were carried along the Dominion Atlantic railway from Aylesford to Clementsport and along the Halifax and Southwestern railway from Middleton to Dalhousie siding. Stadia traverse was carried along the road from Dalhousie siding, via Dalhousie West, to Annapolis, and from Dalhousie West to Bridgetown. These stadia traverses were connected to the main control surveys. On the main control surveys, reference points, permanently marked on the ground by an iron post, or brass plug in concrete, were established at every railway station and at intervals of 2 or 3 miles along the route. Timber limit corner posts and crossings of other land-lines, were connected to the work. Descriptions and positions of all these points can be had on request.

Mr. H. N. Spence assisted Mr. McLean in the work in Ontario and Nova Scotia.

OFFICE WORK

D. A. Nichols remained in the office during the field season and completed the compilation of his topographical surveys for the remainder of standard 1-mile sheets along North Thompson river, British Columbia.

Mr. Nichols, who completed, during the winter months, special studies in physiography at Columbia University, New York, carried on physiographic work for the Geological Survey. He has carried on work along these lines as

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follows: selected and assembled in eight special volumes about 300 views illustrating the physiographic features of Canada with appropriate descriptions of each view; labelled and sent out for educational purposes, about one hundred photo enlargements, with brief descriptions, illustrating physiographic forms; selected and sent out to educational institutions three hundred and fifty lantern slides with titles and descriptive texts; constructed physiographic profiles; selected illustrations; and catalogued for reference much physiographic data.

The regular office work of the division, which consists of the compilation and assembling, drawing up, and inking in of the various map sheets, was carried along in the usual way. Many sheets were completed and turned in for reproduction.

MINERALOGICAL DIVISION

Eugene Poitevin, Chief of the Division, reports as follows:

The vacancy created by the superannuation of R. A. A. Johnston was filled by Eugene Poitevin, who was promoted to Chief of the Division of Mineralogy.

FIELD WORK

H. V. Ellsworth, mineralogist, has continued during the past summer his investigations of the rare earth minerals, which he began a couple of years ago. He visited numerous localities in Quebec and Ontario, incidentally gathering a large collection of valuable minerals for the Museum. An account of his field work will be found in the Summary Report for 1923, Part C I.

A. T. McKinnon, mineral collector, spent the summer months in Ontario and Quebec, where he collected minerals needed for the preparation of our educational collections. Mr. McKinnon also devoted some of his time to collecting for the Economic Museum. Thus, very valuable gold ore specimens were obtained from Porcupine and adjoining camps.

LABORATORY AND OFFICE WORK

This year an unusually large number of visitors seeking information regarding the mineral industry were received by the officers of the division and the performance of this public service probably involves 10 per cent of their working time.

Ores, mineral specimens, and rocks submitted to the Geological Survey for examination were investigated by the writer and reported on as to their nature and their commercial value in 603 memoranda distributed as follows: Alberta 16, British Columbia 114, Manitoba 26, New Brunswick 22, Nova Scotia 41, Ontario 198, Prince Edward Island 2, Quebec 156, Saskatchewan 28.

In addition to the above work and general administration of the division the Chief of the Division has also completed a number of mineral investigations for geologists and mining engineers of the staff of the Department of Mines. A new mineral species was also investigated and its results will be published in the near future.

H. V. Ellsworth was engaged during the winter months on laboratory work in connexion with his field investigations of rare mineral occurrences. He also examined and reported on a large number of samples sent in by prospectors and others interested in rare minerals.

M. F. Connor, rock analyst, completed the following analyses:

Five samples carbonate from Barkerville, B.C.

Two samples salt from $\frac{1}{2}$ mile northwest of Falmouth station, Hants county, N.S.

One sample basalt from $\frac{1}{4}$ mile north of Lava lake, Nass river, B.C.

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One sample talc from Eldorado talc mine, Madoc township, Hastings county, Ont.

One sample potash from Lime river, Pictou county, N.S.

One sample carbonate from lake Winnipegosis, Man.

One sample volcanic glass, from Bellabella, B.C.

Seven samples chromite from Black Lake, Thetford district, Megantic county, Que.

MUSEUM OF ECONOMIC MINERALOGY

A good deal of museum work was done this year. Reclassification has been started—according to more modern methods—of all the mineral specimens in the Museum, and a catalogue of systematic mineralogy, which will be used in the building up of our systematic collections, has been completed. Through the kindness of the late Mr. Jos. Keele and Mr. B. R. MacKay a ceramic and a coal exhibit were added to the other displays of economic minerals in the Museum.

Donations

An Exceptional Donation: A large specimen of extremely rich gold ore from the Dome Mines was presented to the Museum, for which the Department is indebted to the President and Board of Directors and to Mr. DePencier, General Manager of the Dome Mines, Ltd.

Exchanges

Sanukite (clinkstone) from Shiramineyama, Ayaka-gun, Sanuki province; volcanic bombs—Imatate-gun, Fukui-ken, Japan; natro-calcite, Chequi county, Chili; hanksite, Searles Lake, Cal.; zincite-franklinite, Franklin, N.J.; calcite crystals, Lyons, N.J.; vonsenite, Riverside, California; datolite, Westfield, Mass.; stilbite, Moore's Station, N.J., U.S.A.; crystalline orpiment, 600-foot level, White cap, Manhattan, Nevada; orpiment and realgar, 400-foot level, White cap, Manhattan, Nevada; stibnite, 800-feet level, White cap, Manhattan, Nevada; utahlite, vashegyite, barrandite, Manhattan, Nevada; benjaminite, outlaw mine, Mariposa canyon, Nevada, U.S.A.

Purchased

One specimen polished brecciated agate, 1 specimen polished chalcedony, 1 specimen garnetiferous schist, 1 specimen native silver crystals in calcite gangue, 1 specimen amethystine quartz, 1 specimen native copper crystals, two specimens columnar hematite.

Collections too large to be enumerated were made by Mr. H. V. Ellsworth and Mr. A. T. McKinnon and they are now the property of the Geological Survey.

The thanks of the Department are specially due to the following for donations and assistance in the field:

Mr. D. G. H. Wright, the Dome Mines Limited, South Porcupine, Ont.; Mr. R. J. Ennes, McIntyre-Porcupine Mines, Ltd., Schumacher, Ont.; Mr. W. H. Wylie, The Hollinger Mines, Ltd., Timmins, Ont.; Mr. Hugh L. Warren, Timmins, Ont.; Mr. M. A. Wende, Wright-Hargreaves Mines Ltd., Kirkland Lake, Ont.; Mr. D. L. H. Forbes; Mr. R. C. Coffey; Mr. F. L. Culver; Mr. A. J. McGregor; Mr. E. Martin; Mr. W. R. Osborne; Mr. H. B. Davis; Mr. K. B. Heisey; Mr. John I. Ritchie; and Mr. Walter E. Laudon, Kirkland Lake, Ont.; Mr. Alfred Archambault, Goodfish lake, Ont.; Mr. J. C. Nelson, Marchewan,

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Ont.; Mr. Michael Kennedy, Mr. Murray Kennedy, Gowganda, Ont.; Mr. J. G. Dickens, Cobalt, Ont.; Mr. James E. Quirk, Mr. Peter MacDonald, Hybla, Ont.; Mr. R. H. Thompson and Mr. W. R. Robinson, Bancroft, Ont.; Dr. J. Waring, Major Wallbridge, Mr. Donald Henderson, Madoc, Ont.

EDUCATIONAL COLLECTIONS

A. T. McKinnon in charge of this section reports that during the fiscal year collections containing 3,100 specimens were distributed as follows:

Province	Grade I Standard	Grade II	Grade III	Mineral chips	Prospectors
British Columbia.....	.....	1	.....	.....	5
Alberta.....	.....	.....	1	.....	1
Saskatchewan.....	1	.....	.....	7	2
Ontario.....	5	1	31	1	75
Quebec.....	.....	1	2	.....	2
New Brunswick.....	.....	1	1	2	1
Foreign.....	.....	.....	.....	.....	5
Total.....	6	4	35	10	91

A charge of \$35 is made for grade I collection, \$12 for grade II, and \$6 for grade III. The mineral chips, which are residues from the specimens prepared for the collections, and prospectors' sets of minerals, are supplied free to prospectors.

PALÆONTOLOGICAL DIVISION

E. M. Kindle, Chief of the Palæontological Division, reports as follows:

FIELD WORK

The field work of Messrs. Kindle, Bell, and Whittaker is referred to in some detail on pages 11, 12, 13. Through their field work the palæontological collections of the Survey have been increased by collections of Coal Measures plants from Nova Scotia, Devonian fossils from James Bay district, Cretaceous fossils from Alberta, and Palæozoic fossils ranging from Cambrian to Carboniferous in British Columbia. The field work of C. M. Sternberg in the Edmonton formation of the Red Deer River valley, Alberta, resulted in important additions to the dinosaur collections of the Survey.

OFFICE AND LABORATORY WORK

The office work has included the preparation by members of the division of reports on fossils for other geologists of the staff, and on various small collections from outside sources.

About forty small collections of fossils for educational purposes have been prepared and sent out.

Messrs. Sternberg, Skillen, and MacDonald have continued the preparation of the extensive dinosaur collections throughout the year, except when interrupted by field work.

The palæontological work of W. A. Bell has included the identification and study of: (1) a small collection of fossil shells and plants made by him from Madame island, C.B.; and of (2) two large collections of fossil plants from Minto, New Brunswick. The determination of the first lot of fossils proved that the Madame Island rocks from which the fossils were obtained are of Horton age and unpromising as a potential source of workable coal. The

study of the Minto collections comprised the identification of fifty species of fossil plants and these fixed the approximate position of the Minto coal seam in the Coal Measures system and established its age relation to various horizons elsewhere.

EXHIBITS

During the year the museum exhibits in the Hall of Palæontology have been enriched by the installation of a collection of fossil Coal Measures, trees and stumps. One specimen shows what is probably the most complete set of Coal Measures tree roots ever excavated. The forest group in which they have been assembled includes twelve specimens, representing chiefly the genus *Sigillaria*, which were collected from the section at Joggins, N.S., by C. M. Sternberg and mounted by J. Skillen and S. K. MacDonald. The fossil trees have been mounted in the upright position in which they were found in the rocks. An oil painting by A. Miles showing a restoration of a living Coal Measures forest forms the background of the fossil forest exhibit.

An exhibit representing the palæontology of man was loaned to the division by Dr. H. M. Ami during the greater part of the year.

DONATIONS

Among the noteworthy accessions to the series of lithologic specimens of the division are a series of marl balls from the lakes of Michigan, presented by Professor Ehlers of the University of Michigan. Dr. A. F. Foerste has presented the Survey with several types of Ontario Ordovician fossils and specimens of marlstone from localities in the northern states.

BORINGS DIVISION

Mr. E. D. Ingall, Chief of the Borings Division, reports as follows:

With the accelerated development of the internal combustion engine during the past two decades and the vast increase in the number of uses to which it has been applied, has come a tremendous increase in demand for gasoline, etc., and a consequent activity in the well-boring business in the search for supplies of petroleum in every part of the world. The coincident discovery of supplies of natural gas has also added to the greatly increased use of the drill in the search for, and development of, pools of this very cheap and convenient fuel.

With the present enormously increased demand for petroleum and natural gas, etc., and with the great depths necessitated in the effort to explore the deeper formations, the need for using all available knowledge of geological conditions is being gradually recognized. The monetary loss where a badly placed very deep well is involved, running to perhaps about \$100,000, emphasizes the need for the application of all obtainable knowledge of conditions likely to be helpful in solving the serious problem of location where the best chances for success seem to exist.

Because in the early days of shallow wells, skill in his art on the part of the driller, together with a "rule of thumb" knowledge of local geological conditions, seemed sufficient for practical results, a tradition has grown up that the application of the systematized knowledge of geology is unnecessary. However, the need for taking advantage of all available geological knowledge has of late years been recognized by the larger organizations, so that they now employ corps of highly trained specialists. Thus, not only are the geological data already accumulated available for the solution of the problems encountered, but further extension of the knowledge of the local conditions can thus be accumulated and applied through the expert study of the samples of the strata pierced and of other phenomena experienced as the boring progresses.

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But, though the great value of systematic and scientific study of district conditions is thus recognized by the larger concerns, much educational work remains to be done to get this principle recognized by the smaller operators.

The need of government action in this matter was recognized in the clause of the Dominion Act of Parliament creating a Department of Mines (6 and 7, Edward VII, Chap. 29), wherein the Geological Survey Branch was entrusted with the work of collecting records of boring operations throughout Canada. When the writer was instructed to undertake this work, the organization of the Borings Division was commenced along lines recognizing the conditions set forth above.

The activities of the division consist in:

(1) Keeping in touch with boring operations throughout Canada, whether for petroleum, natural gas, salt, water, or anything that can be so exploited, and communicating with operators so as to secure their co-operation with the work.

(2) The collection of as many boring records as possible and incorporating all such data in a filing system such that they may be always available for use in connexion with future operations. Care is exercised to avoid giving away private and confidential data so that confidence in the division may be maintained. In most cases, however, it is found that operators are willing after a certain lapse of time to allow their records to be freely used. Even where this is not the case, such confidential data are of great assistance in arriving at *general conclusions* regarding the various districts.

(3) The acquisition of complete and carefully taken sets of cuttings resulting from the action of the standard drill, or of cores where a core-drill is used, and the filing of these for intensive study later.

(4) Setting out a part of each sample on arrival at the office and chemico-microscopic interpretation of the material as desired by the operators for their guidance during the progress of the work.

This interpretation involves the correlating of the cuttings with some geological section which has been already established through surface geological studies in the district, made during the course of the regular field work of the Geological Survey. The need for promptitude in this matter has resulted in the development of rapid approximate microscopic and chemical methods of determining in a roughly proportionate way the main constituent of the cuttings, such as lime and magnesium carbonates; the argillaceous contents, and the insoluble, mostly siliceous, residues. Some idea is also to be gained of the fineness or coarseness of the original constituents as having a bearing on the original porosity of the sediments. In some cases too, clues are obtained as to how far this original porosity has been obliterated by filling in of interstitial space by deposition of secondary minerals.

The following is a list of the wells for which graphic logs prepared as above stated:

Central station, Ottawa, Ont.
Lot 28, con. I, Cramache tp., Ont.
Lot 11, con. III, Vaughan tp., Ont.
Lot 11, con. I, W. Flamborough, Ont.
Lot 7, con. IV, Puslinch, Ont.
Lot 5, con. X, Tilbury W., Ont.
Lot 1, con. I, Dover West, Ont.
Lot 19, con. III, Romney, Ont.
Lot 26, con. VI, Dawn, Ont.
Lot 24, con. V, Dawn, Ont.
Squaw Bay, Fort William, Ont.

Sec. 3, tp. 42, range XXVI, W. P. M., Man.
Crowsnest, Sage Creek, Flathead river, B.C.

(5) Intensive study of the material of the samples, which it is hoped may add to the knowledge of the detailed character of the sedimentary strata and that this additional knowledge will be practically applicable to boring problems in the future. This phase of the work is now carried on by Mr. D. C. Maddox.

(6) Answering numerous inquiries from all over Canada from those who are prosecuting or contemplating boring in search for petroleum, natural gas, water or salt, etc.

Nova Scotia. Little is done in deep borings of the character which engages the attention of the Borings Division. Considerable core drilling is continually carried on by private companies interested in coal, gypsum, etc., but the results of such borings are illustrative of the details of the mineral deposits tested and of interest only to the owners.

New Brunswick. Thanks are due to the New Brunswick Gas and Oilfields Company, for a continuance of their assistance of past years in sending any available additional information regarding their borings, as well as sets of samples illustrative of the deeper strata of their field as developed in deepening their wells. The New Brunswick Cold Storage Company of St. John continued their borings in search for plentiful supplies of water for cooling purposes. Considerable correspondence has been carried on in an effort to place at their disposal all that is known regarding the geological conditions in the vicinity of their works. The samples sent by them were examined as received and reported on.

Quebec. In Gaspé district, where in past years considerable boring was done following seepages of oil, correspondence was entered into with Mr. C. S. Le Boutillier, having in view the acquirement by the Borings Division of sets of samples from these old borings. These were reported to be still stored in the district by A. W. G. Wilson of the Mines Branch staff. Arrangements were made to acquire these samples later if an inspection could be made by one of the field geological staff to see if they are in such a state of preservation as to be of use in the study of that district.

Ontario. The part of this province lying east of the Archæan divide which crosses the St. Lawrence at the Thousand islands, is geologically a western extension of the Palæozoic series of Quebec province. Although small amounts of natural gas have been proved by borings, most of the wells put down are in search for water, chiefly for cooling purposes. Further knowledge of the Ordovician strata of this territory resulted from the study of cuttings from two deep wells. One was put down at the Central station, Ottawa, by the Wallace Bell Company of Montreal, for the Canadian National railways. The other was bored by Mr. Muir on the property of the Ottawa Valley Dairy on Sparks street. Information gained in the past from numerous deep borings in the city was placed at the disposal of the Dairy Company for their guidance.

The rock formations in the vicinity of the new locks being constructed at Cornwall, Ontario, were discussed with the officials of the Department of Railways and Canals, and a report made on the cores submitted. Co-operation with the same department was accorded in connexion with cores submitted from a lock-site near Port Colborne on Welland canal. Graphic geological sections were compiled from data given in the published reports of the Geological Survey and diagrams made for the use of the engineers illustrative of the strata which will be encountered in excavating the lock in question. Cores illustrative of the strata at Morrisburg on the St. Lawrence were received from Mr. Cole of the Mines Branch and put on file.

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In the peninsula of Ontario are situated the old established oil and gas fields which have received considerable attention from the Geological Survey in past years. Following the geological mapping done previous to 1863 by the Survey, under Sir William Logan, its first Director, came the investigations by C. R. Stauffer and M. Y. Williams in the years 1917 to 1920.

Amongst the borings, with the owners of which the division has been in direct communication, are two of special interest. One is in Emily township, Victoria county, by the Northern Development Company; the other at Colborne, Northumberland county, by the Central Ontario Oil Fields. Sets of samples received from these operators were examined during the progress of the wells. These were reported on to the owners, who were also given advance geological information for their guidance. Both these borings started in the Trenton limestone, so that only a few hundred feet would be penetrated before encountering the old sea-bottom surface on which the sediments were deposited. In some districts, zones of crystalline limestone are present in this Precambrian floor. These limestone zones are so narrow and so limited to certain districts that only by rare chance would they be encountered by drilling. Such an interesting and unusual happening occurred at the well at Colborne already spoken of. At this point the boring was continued below the Palæozoic sedimentaries and penetrated the crystalline limestone about 230 feet.

Another boring which penetrated the Precambrian ("granite") was that put down in Vaughan township, a short distance north of Toronto. This boring started in the Richmond and Lorraine formations and, passing down through the usual thickness of this and of the Utica shales and Trenton, Black River limestones, and the underlying arkose, encountered the Precambrian ("granite") at 1,167 feet in depth. Rumours were current that this latter was again underlain by limestones and shales, but no proof was forthcoming of such a revolutionary idea.

Another well geologically very similarly placed to the above mentioned was under study during the year, viz., that of the Sterling Development Company at Oakville, Ontario, west of Toronto. For receiving a set of samples from this well, thanks are due to Mr. A. W. Furbank, B.Sc. This boring was made in search for water.

Samples are being received from the well of the Mulberry Creek Oil Company in Eastnor township, Bruce county. This is especially interesting as adding to our knowledge of the strata in depth in that part of the province lying between the proved oil and gas-bearing territory adjacent to lakes Erie and Ontario on the south, and the explorations for oil which were made farther north on Manitoulin island. North of the wells bored for salt around Goderich and Kincardine lies a strip of country along the shores of lake Huron where borings from which samples have been received are few. New ones are, consequently, of especial interest as giving an opportunity to work out the character of the strata directly from samples.

Thanks are due to Mr. A. E. Annis for his co-operation in sending samples from the continuance of his boring on the shores of Thunder bay near Fort William. As the strata in that region are practically flat-lying, knowledge of their characteristics in depth can only be got through deep borings.

Through the courtesy of Mr. H. M. Davey, Chief of the Test Borings Branch of the Public Works Department, plans of the borings made in Goderich harbour were received, together with sample cores illustrative of the underwater rock outcrops.

Thanks are due to Mr. F. J. Carman, now of New York, for a continuation of his co-operation of past years in contributing data to the files of the division. This assistance is exceptionally valuable based as it is on his years of systematic study of the problems involved in the search for gas and oil in Ontario.

Northwest Provinces. In the great Cretaceous area of the central provinces boring operations on public lands are under the control of the Dominion Government through the Mining Lands and Yukon Branch. Thanks to the co-operation of the field inspectors the Borings Division has been kept in touch with such operations and receives copies of all logs of wells and other data reported to them.

Interesting geological results have been obtained through the experimental borings at Mafeking in northwestern Manitoba and in Pasquia hills still farther northwest. The former well is being put down by the Northern Manitoba Oil Company and the latter by the North Battleford Gas and Oil Company.

Thanks to the hearty response of Mr. A. O. Gothenquist of the Porcupine Mountain Oil Company in sending drill cuttings and co-operating in other ways, valuable information has become available as to the geological conditions in depth at Mafeking. These show that the well was started in Cretaceous strata, the Benton shale with the Dakota sandstones below. At a depth of 490 feet this boring passed into underlying light-coloured limestones of Devonian age.

Samples are being sent by the North Battleford Gas and Oil Company, but those so far received to a depth of 300 feet show that, from their Pasquia Hills well, the Devonian strata had not been encountered.

The two above-mentioned borings represent the extension northward of a series of test borings under similar geological conditions. They were located at long intervals apart, from that at Morden near the International Boundary to the most northerly point at Pasquia hills. Well records are available from Morden, Rathwell, Neepawa, Vermilion river, Mafeking, and Pasquia hills. They were all situated near the eastern edge of the Cretaceous strata, and at depths of from 400 to 600 feet pass into Palæozoic strata below.

Farther west in Alberta and western Saskatchewan, where search for oil and gas has been vigorous for years, the problems have been under study by officers of the field staff of the Geological Survey and the collection of logs of borings form an evident feature of such investigations. Thanks to the co-operation of the undermentioned companies, etc., who dealt directly with the Borings Division, further additions were made to the geological information accumulated in the files of the division.

Well logs were received from the Canadian-Petroleum Company's well at Peace River; from the well of the McDonald hotel at Edmonton, Alberta, through Mr. H. P. Blake of the Canadian National railway, Winnipeg; from the well of the Mutual Oil and Gas Company (sect. 14, tp. 47, range XXVII, W. of 4th mer.), from the Birch Lake and Monitor wells, through Mr. J. R. Talpey of Calgary. In the Wainwright-Irma field a log and samples were received from the British Petroleums Company of their No. 1 well.

Communication has been had with the following western coal companies whose campaign of borings in proving their coal seams might give information in their districts, viz., The Coal Valley Mining Company (sect. 35, tp. 47, range XX, W. of 5th mer.), the Mountain Park Coal Company (sect. 33, tp. 45, range XXIII, W. of 5th mer.), the Luscar Collieries (sect. 23, tp. 47, range XXIV, W. of 5th mer.).

Some samples were received direct from the Medicine Hat Petroleum Company, but the southern districts of Alberta being under study by E. J. Whittaker and M. Y. Williams, the information added to the files of the Borings Division has been received through their instrumentality. One especially interesting addition comes from the deep-test well of the Border Oil Company in Coutts district, southern Alberta (depth 2,010 feet). This is especially important as having been put down with a core-drill, so providing for more exact knowledge of the character of the deep-seated strata than would

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be obtainable from samples in a pulverized condition resulting from the action of the standard churn-drill or from the rotary-drill. There are now on file in the division samples of this set of cores selected by M. Y. Williams as illustrative of the various strata penetrated. The very fragile nature of the cores prohibited shipment of the whole series. A detailed log as made out by Dr. Williams is, however, available for reference in the files of the division.

British Columbia. In British Columbia the series of deep borings in Fraser River delta were studied and reported upon by W. A. Johnston of the Geological Survey (See Memoir 135).

Through the efforts of Mr. T. B. Williams, a selected set of cores was received from one of a series of borings made by the Canadian Collieries, Limited, at Comox, B.C., in testing their properties for coal. These cores were examined by Mr. Maddox.

The boring for oil on Sage creek, Flathead valley, was continued during the year, but owing to its isolated position it was found difficult to keep in touch and only a few samples were received. These did not show any material change of formation from the quartzites penetrated in the upper part of the boring.

During its existence, the Borings Division has attempted to gather such data relating to water supplies as could be ascertained through correspondence. In this connexion thanks are due to the following drilling contractors who have responded by filling in the questionnaires sent out: Messrs. A. Darveau, St. Marc des Carrieres, Portneuf, Que.; Stanley Rennick, Bright, Ont.; Thos. Moore, Landis, Sask.; Mr. W. Y. Porter, Kelfield, Sask.; Chas. Hilm, Craik, Sask.; Dominion Well Company, Eston, Sask.; M. Clark, Turtleford, Sask.; Emeet Freer, Leask, Sask., Canadian Well Supply Company, Regina, Sask.; D. Collins, Regina, Sask.; Duncan Bros., Redfield, Sask.

Of the circulars and personal letters of inquiry sent out by the Borings Division, a certain proportion as usual failed to elicit a reply, but as the knowledge of the practical value of this work becomes more widespread, this difficulty should gradually remedy itself.

Amongst those not already mentioned who have rendered valuable aid to the Borings Division, may be mentioned: Messrs. F. W. Langton, Barrie Island, Ont.; E. Fitzgerald of the Hudson's Bay Company; R. Lebkicker of the Many Island Oil and Gas Company and the Community Oil Wells, Ltd.; C. C. Ross, Dominion Government Mining Inspector, Calgary, Alta.; John D. Sterling, Government Inspector of Mines, Edmonton, Alta.; also Professors J. A. Allan, A. E. Cameron, P. S. Warren, and Norman Pitcher, all of the staff of the University of Alberta.

Especial thanks are due to the Imperial Oil Company, who have continued co-operation with the Borings Division during their campaign of boring carried on in the past few years. As promised by the company, the division is in receipt of sets of samples and of logs and other valuable data from their deep wells. Special thanks are due to Mr. John Ness of the company's geological staff for his continued help.

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	Number of sample bags sent out	Number of samples received	Number of borings from which samples were received	Number of records received
Maritime Provinces.....	550	1,338	7	8
Quebec.....	100	57	1	11
Ontario.....	830	4,240	43	53
Northwest Provinces.....	3,440	3,487	30	144
British Columbia.....	110	1,263	9	15
Total.....	5,030	10,385	90	231

The following notes by Mr. Maddox are explanatory of the work done in making laboratory studies of the well samples:

A preliminary examination was made of diamond drill-cores from the coal field of Comox, Vancouver island, and special methods were devised for the purpose of obtaining the maximum information from the conglomerate cores of these wells without entirely disintegrating them.

Detailed work was performed on certain parts of a diamond drill-core at Hudson Hope, special attention being paid to the sandstones and conglomerates of this section. It was hoped that information relative to the source of such material might be obtained by this means.

An examination of the samples obtained from the deep well at Pouce Coupé was undertaken with the hope that such work would aid in the elucidation of the problem of the correlation of the Cretaceous formations of Peace River and Athabaska areas, with the formations of about similar age lying farther to the west in the foothills region.

With reference to the southwestern peninsula of Ontario, preliminary work was done on the following wells: Union Gas Company Nos. 5, 4, 10, and 15; Eugene Coste No. 4; the object of such work being the location of the chief geological horizons in that area. This was undertaken in response to an inquiry by Col. R. B. Harkness, Gas Commissioner of Ontario.

Considerable time and attention were devoted to the examination of samples obtained from the deep well in Romney township in which oil was obtained near the base of the Trenton. The examination involved a palæontological section and the determination of material insoluble in hydrochloric acid and the percentage of magnesium carbonate in the Trenton limestone at certain points, more especially those just above the oil horizon, was also undertaken. Samples from Coste well No. 3 in the same oil field were tested similarly for magnesium.

In connexion with the magnesium carbonate content of the Trenton limestone, preliminary acid tests, followed by detailed chemical work should the result of the preliminary observation justify it, was carried out on Union Gas Company's wells Nos. 2 and 10 in the Dover West field, to ascertain whether the high magnesium horizon of the Romney field extended into the Dover West field, and also to determine if any definite connexion existed between the oil horizons and the high magnesium zones.

In the northern part of Ontario peninsula some detailed work was done on the Mulberry Creek Oil Company's well in Bruce county. This was with the object of correlating with the known geological horizons at this point.

At the request of the engineers of Welland canal, an examination of core-drills from three bore-holes near Humberstone was undertaken. The cores were obtained from a proposed lock-site and information was desired as to their lithology, structure, and geological horizon.

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Work was undertaken on a well at Squaw bay near Fort William which was put down in the Animikie formation at that point. Special work on the samples, involving the determination of specific gravity and some optical work on certain samples of high specific gravity, aided in the solution of some problems involved through the identification of two diabase sills.

A drill-core from the volcanic ash bed situated near Waldeck, Sask., was examined. The chief rock types were identified, optical tests being applied in some cases. A partial mechanical analysis of several portions was made. The results were plotted, and afforded a useful graphic record of the distribution of the volcanic ash through the section.

GEOGRAPHICAL AND DRAUGHTING DIVISION

C.-Omer Sénécal, Chief of the Division, reports as follows:

One promotion to the position of principal map draughtsman has taken place in the staff; two vacancies of senior map draughtsman still remain to be filled by the Civil Service Commission. The work was carried on by the same personnel, composed of the chief, four principals, two seniors, one engraver, and two clerks, as in previous years.

Twenty-five new maps were completed and published; seven are at present in the hands of the King's Printer, for lithographing and printing; the engraving on copper of one (three plates), is in progress; and fifteen other maps, exclusive of the Nova Scotia series of sheets, are at various stages of progress in the office.

The general map of northeastern Ontario (publication No. 1553) on the scale of 1 inch to 8 miles, referred to in last year's report, embodying the result of geological work up to date, and comprising an area of about 80,000 square miles, has been published. No progress has been made on the adjacent general map of western Quebec since last year.

A series of similar general maps of large sections of the country having been decided upon by the Director, the compilation of a base-map of southern British Columbia, on a large scale, was undertaken, and is now practically completed. Photographic copies of this base-map will be supplied to the geologists, in time for the coming field season.

Geological field work of the past summer has been incorporated in the detailed map of Bruce Mines area, Ont. The publication, however, is held over until further investigations are made in the eastern part of the area. The companion maps of Blind River and Lac Panache areas, Ont., on the scale of 1 inch to 2 miles, are ready for publication.

A third edition of the map of the Dominion of Canada and Newfoundland, on the scale of 1 inch to 100 miles, has been sent to the printer, for publication and distribution at the British Empire Exhibition, Wembley, England.

A map showing waterways connected with Hamilton inlet was also compiled and drawn for use by the Department of Justice.

A large number of zinc-cut and other drawings of sketch maps, text figures, diagrams, etc., were executed for the illustration of memoirs, bulletins, and reports, and for sundry purposes.

Steady progress was made in the cataloguing of field books, survey records, and other documents kept in this division.

Duties of the Chief of the Division in connexion with the Geographic Board of Canada, on the Executive Committee of which he is a member, were duly attended to.

A descriptive bulletin on three-colour geological map printing, illustrated with colour plates, was also prepared by the Chief of the Division.

A list of maps in progress at the Printing Bureau, on March 31, 1924, and a list of maps published during the fiscal year, are given below:

Maps in Hands of King's Printer, March 31, 1924

Public- ation number	Title	Date of requisition	Remarks
1277	Geological map of the Dominion of Canada and Newfound- land; scale, 1 inch to 100 miles.....	Feb. 13, 1924	Third edition
1902	Thunder cape, lake Superior, Ont.; scale, 1 inch to 3,000 feet.....	Dec. 28, 1923	Geology
1960	Vogler cove, sheet No. 90, Lunenburg county, N.S.; scale, 1 inch to 1 mile.....	Sept. 8, 1922	Geology
1981	Chester basin, sheet No. 87, Lunenburg county, N.S.; scale, 1 inch to 1 mile.....	Sept. 8, 1922	Geology
1988	Coquihalla River area, Yale district, B.C.; scale, 1 inch to 1 mile.....	Sept. 19, 1923	Geology and topography
1995	Cross and Pipestone Lakes area, Man.; scale, 1 inch to 2 miles.....	Nov. 20, 1923	Geology
2022	Mackenzie river, between Wrigley and Norman, Mackenzie district; scale, 1 inch to 8 miles.....	April 1, 1924	Geology

Maps Published April 1, 1923, to March 31, 1924

Public- ation number	Title	Remarks
	NORTHWEST TERRITORIES	
1763	Arctic coast of Canada, between Darnley bay and Bathurst inlet, Mackenzie district; scale, 1 inch to 10 miles.....	Geology. Can. Arctic Exp., 1913-1919
1977	Mackenzie river between Norman and Beaver river, Mac- kenzie district; scale, 1 inch to 8 miles.....	Geology. In report by G. S. Hume, part B, Summary Report, 1922
	BRITISH COLUMBIA	
1897	Coquihalla River area, Yale district; scale, 1 inch to 1 mile.	Topography
1933	Fraser River delta; scale, 1 inch to 1 mile.....	"
1961	Barkerville area, Cariboo district; scale, 1 inch to 1 mile....	"
1965	Fraser River delta; scale, 1 inch to 1 mile.....	Geology and topography. In Memoir 135, by W. A. John- ston
1996	Clearwater River and Foghorn Creek sheets, North Thomp- son valley, Kamloops district; scale, 1 inch to 1 mile...	Topography
1997	Chu Chua Creek sheet, North Thompson valley, Kamloops district; scale, 1 inch to 1 mile.....	"
1998	Louis Creek sheet, North Thompson valley, Kamloops dis- trict; scale, 1 inch to 1 mile.....	"
	BRITISH COLUMBIA AND ALBERTA	
1962	Palliser-Kananaskis area; scale, 1 inch to 2 miles.....	Topography
1980	Upper Elk and Upper Highwood rivers; scale $\frac{1}{250,000}$	Geology and topography
	ALBERTA	
1979	Artesian area, southern Alberta; scale, 1 inch to 6 miles.....	Geology. In report by D. B. Dowling, part B, Summary Report, 1922
1993	Cadomin sheet, townships 46, 47, 48, and 49, ranges 23 and 24, west of fifth meridian; scale, 1 inch to 1 mile.....	Topography
	ALBERTA AND SASKATCHEWAN	
1991	Lake Athabaska; scale, 1 inch to 8 miles.....	Geology

Maps Published April 1, 1923, to March 31, 1924—Continued

Public- ation number	Title	Remarks
	SASKATCHEWAN AND MANITOBA	
1978	Part of the Flinflon group of claims; scale, 1 inch to 250 feet..	Geology. In report by F. J. Alcock, part C, Summary Report, 1922
	MANITOBA	
1992	Preliminary map of a portion of Rice Lake mining district; scale, 1 inch to 1 mile.....	Geology. In report by J. F. Wright, part C, Summary Report, 1922
	ONTARIO	
1553	Portions of the districts of Algoma, Sudbury, and Timiskaming; scale, 1 inch to 8 miles.....	Geology
1972	Michipicoten area, Algoma district; scale, 1 inch to 1 mile...	"
	QUEBEC	
1982	Sagamité peat bog, Quebec county; scale, 1 inch to 2,400 feet.	Economic geology. In report by A. Anrep, part D, Summary Report, 1922
1983	Breakeyville peat bog, Levis county; scale, 1 inch to 2,400 feet.....	" "
1984	St. Jean peat bog, Levis county; scale, 1 inch to 2,400 feet....	" "
1985	Opasatika area, Timiskaming county; scale, 1 inch to 1 mile.	Geology. In report by H. C. Cooke, part D, Summary Report, 1922
1987	Duparquet area, Timiskaming county; scale, 1 inch to 1 mile.	Geology. In report by W. F. James, part D, Summary Report, 1922
	NEW BRUNSWICK	
2007	Minto sheet, Sunbury and Queens counties; scale, 1 inch to 1 mile.....	Topography
	NOVA SCOTIA	
2006	Map of Nova Scotia, showing physiographic divisions and some effects of glaciation; scale, 1 inch to 1 mile.....	In Memoir 140, by J. W. Goldthwait

MAP ENGRAVING DIVISION

Robert Veitch, in charge of the Map Engraving Division, reports as follows:

Maps Completed

- Topographical map, Chu Chua Creek sheet (North Thompson valley), Kamloops district, British Columbia; scale, 1 inch to 1 mile. Engraved for reproduction in three colours; three plates engraved.
- Topographical map, Louis Creek sheet (North Thompson valley), Kamloops district, British Columbia; scale, 1 inch to 1 mile. Engraved for reproduction in three colours; three plates engraved.
- Topographical and geological map, Chester Basin sheet, Nova Scotia series; scale, 1 inch to 1 mile. One plate engraved.
- Topographical map, Minto sheet, Sunbury and Queens counties, New Brunswick; scale, 1 inch to 1 mile. Engraved for reproduction in three colours; three plates engraved.
- Map of Nova Scotia showing physiographic divisions, and some effects of glaciation; to accompany memoir by J. W. Goldthwait; scale, 1 inch to 8 miles. Two plates engraved of geological information shown on map.
- Topographical map, Copper Mountain mining area, Similkameen district, British Columbia; scale, 1 inch to 1,000 feet. Engraved for reproduction in three colours; three plates engraved.

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Topographical map, Courtenay sheet, Vancouver island, British Columbia; scale, 1 inch to 1 mile. Engraved for reproduction in three colours; three plates engraved.

Topographical base plates, in three colours, necessary for the make-up of the geological map of Courtenay-Cumberland area, Vancouver island, British Columbia; scale, 1 inch to 1 mile.

Geological map of the Dominion of Canada and Newfoundland; scale, 1 inch to 100 miles. Engraving executed for geological edition; two plates engraved.

The engraving of projections and laying down of offsets necessary for the engraving of the following maps: topographical map, Cadomin sheet (townships 46, 47, 48, and 49, ranges 23 and 24, west of fifth meridian) Alberta; scale, 1 inch to 1 mile. Projection and offsets for three plates.

Topographical map, Thunder Cape sheet, Ontario; scale, 1 inch to 1 mile. Projection and offsets for three plates.

Maps in Progress

Topographical map, Springhill sheet, Cumberland and Colchester counties, Nova Scotia; scale, 1 inch to 1 mile. Three plates.

Mineral map of the Dominion of Canada; scale, 1 inch to 100 miles. Two plates.

Topographical map, Fort William and Port Arthur sheets, Ontario; scale, 1 inch to 1 mile. Three plates.

During the year the indexing of the engraved copper-plates of the Geological Survey was begun and good progress made on same.

PHOTOGRAPHIC DIVISION

G. G. Clarke, Chief Photographer, reports that the following work was done by this division during the year:

	Inches	Inches	Number
Contact prints..	4 by 5	to 36 by 48	15,305
Bromide enlargements..	4 by 5	to 40 by 72	917
Exposures developed..	3½ by 4½	to 6½ by 8½	4,895
Dry plate negatives..	4 by 5	to 11 by 14	572
Wet plate negatives..	8 by 10	to 24 by 30	188
Zinc plates..	11 by 14	to 24 by 36	30
Photostat copies..	7 by 11	to 11 by 14	458
Lantern slides..	3½ by 4	.....	1,116
Photos and titles mounted.. . . . .	.....	.....	2,947
Total.			26,428

GEOLOGICAL INFORMATION AND DISTRIBUTION DIVISION

Wyatt Malcolm, Chief of the Division, reports as follows:

The work of the division consists in giving information regarding the geology and mineral resources of Canada. This information is imparted verbally to men making application in person, and is given also in the form of correspondence, memoranda, and published reports and maps. A considerable part of the technical correspondence of the Geological Survey is dealt with.

Articles were prepared during the year for publication in the Gazette, Industrial Canada, the Canada Year Book, the Canadian Magazine, and the Canadian Mining Journal. These articles treat of such subjects as the importance of the mineral industry of Canada, the status of the industry, and the progress made. Numerous short articles have been prepared for the use of the press and have been well received. In this way the readers of the newspapers have been informed of the nature of the publications that have been issued from time to time by the Survey. Short statements presenting in language free from technical phraseology the results of recent investigations by the field officers have also been welcomed by the press and up-to-date information has thus been made available to a large public of non-technical readers.

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The growing tendency on the part of the members of the staff of the Geological Survey to present the results of their work in non-technical language is appreciated and may account in part for the demand on the part of the investing public for their reports. Plain statements summing up conclusions as to the chances for discovering minerals in commercial quantities are desired, and warnings against the expenditure of money in the search for minerals in unpromising areas are of great benefit.

The distribution of the publications of the Geological Survey and of the Victoria Memorial Museum is made by this division. During the year 66,644 publications, exclusive of the French editions, were distributed. Of these, 11,695 were sent to addresses on the regular mailing lists and 54,949 were distributed in compliance with written and personal requests for named publications, or requests for general or specific information.

INVESTMENT IN MINING STOCKS

Numerous requests of a certain character received at this office suggest the uttering of a note of warning to the public regarding the highly speculative nature of certain phases of the mining industry, more particularly those phases that are antecedent to the stage in which the mine is placed on a dividend-paying basis.

In its early phases it is an extremely hazardous venture; in fact, mining in general is regarded as risky and it is not an industry in which trust money should be placed. Prospectors and miners are inherently optimistic and it is the element of risk that gives zest to their pursuits. They are always buoyed up by the hope of striking something very rich and making a good clean up.

The prospector may spend many of the best years of his life in the search for the elusive metal without striking anything of value; minerals of value seem to have the unhappy faculty of concealing themselves in out of the way places and under the cover of vegetation or soil. Hundreds of claims are staked for no better reason than that they lie in the vicinity of a discovery that looks encouraging, and a thousand claims are staked for every one that develops into a mine of importance. Thus the grubstaking of even the most conscientious prospector is in itself a matter of great risk.

Much risk also attends the investigation of the most promising discoveries made by the prospector. It is at this point that considerable capital is usually required; diamond-drilling, sinking shafts, driving levels, crosscutting, and extensive and careful sampling are necessary to determine the extent and character of the presumptive ore-body. Many factors in addition to the size and richness of the deposit enter into the problem of economic possibilities. Transportation difficulties, labour costs, difficulties that may arise in the metallurgical treatment of the ore, metal markets, and sources of power must all be weighed. Combinations of embarrassing conditions eliminate from further consideration a large proportion of the apparently promising prospects even after a considerable amount of money has been spent on them. Many of those on which mining operations are continued never pay dividends and many others pay dividends only after several years of careful and persistent effort has been expended on them. The Hidden Creeks, Britannias, Sullivans, Creightons, Nipissings, and Hollingers are few.

There should be little difficulty in Canada in procuring the development of a really promising prospect. Many mining companies and investment corporations are glad to take a venture on a property that looks worth while, and a great deal of money is being spent in Canada by such companies at the present time in the search for mineral deposits of value. These companies have a clear understanding of the chances they are taking and employ the best

of skilled and technical advice so as to reduce the risk to a minimum. They go about their work with very little blowing of trumpets; they do not fill the daily press with full-page advertisements, or flood post offices with lurid prospectuses. It is against much of the get-rich-quick propaganda in which all risks are minimized that the unthinking public is to be warned. First-class properties do not require this method of financing. Too frequently, in addition to the risks already mentioned as attending the investigation of the commercial possibilities of a mineral deposit, may be added the unreliability of the management.

Investment in the stocks of mining companies that have reached the dividend-paying stage is, also, generally conceded to be highly speculative. There are few stocks more subject to wide market fluctuations; they lend themselves readily to market manipulation; the exhaustion of an ore-body, a discovery of a new ore-body, a change in management, labour difficulties, rumours of developments affecting available ore, developments on adjoining properties, increase of mining costs, or fluctuations of the metal market may serve to bring about marked increases or decreases in the prices of the stocks.

Mining is, however, a legitimate speculation. It is a speculation in which there is great risk; it is the counterbalancing possibility of great gains that makes it attractive. The development of the industry is dependent on men and companies who understand the business and are prepared to take long chances. In the prospecting and development stages no man should place more money than he can afford to lose. The more hazardous, but useful, ventures might well be left to those who are familiar with the mining game and know how to minimize the attendant risks.

LIBRARY

Mrs. F. E. Forsey reports marked progress in the work of the library during the year, both in the widening of its usefulness and in the number and value of its accessions.

The additions to the library during the year include:

Volumes received as gifts or exchanges.. . . .	661
Books purchased.. . . .	595
Pamphlets and government publications.. . . .	859
Maps received.. . . .	260
Periodicals subscribed for.. . . .	165
Periodicals received as exchanges.. . . .	336

The number of volumes bound was 544, of maps mounted, 136, and 3,579 cards were added to the catalogue. Publications of twenty-eight learned societies and institutions were added to our exchanges during the year. The work of keeping the files complete by requests, claims, and acknowledgments amounted to over five hundred pieces of correspondence.

The library has continued to an increased extent to loan books and give bibliographic information to scientific workers through the system of inter-library loans and reference. At the request of members of the staff, books have been borrowed from the Library of Parliament, several departmental libraries, the Carnegie Library of Ottawa, McGill University Library, Toronto University Library, American Geographical Society and Engineering Societies' Library, New York, the Library of Congress, United States Weather Bureau Library, and the Library of the United States National Museum, Washington.

Books, periodicals, and maps have also been loaned to the Botanical and Entomological Divisions of the Department of Agriculture; to the Parks Branch, Natural Resources Branch, and Topographical Surveys of the Interior

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Department; Dominion Observatory; Government House; the Normal School; McGill, Toronto, and Alberta Universities; and the Royal Ontario Museum, Toronto.

Considerable progress has been made in classifying and filing the collection of valuable pamphlets which have been stored away for some years. These are being divided as follows: *volumes*, i.e., unbound pieces of over 100 pages, or pamphlets so important as to justify binding and treating as books; *pamphlets*, i.e., independent publications unbound and less than 100 pages, which are catalogued and filed in vertical cabinets; *reprints or excerpts*, i.e., duplicates or separates of articles already in the library in the periodicals; and *theses*. The *reprints* are being filed alphabetically under the authors' names, in the larger groups specially adapted to this library, the geological sciences being already represented by 4,105 reprints; whereas *theses* of particular value are being treated as separate works, otherwise they are catalogued as publications of the respective universities.

Work on the collections of maps, photographs, and lantern slides has been carried on as efficiently as is possible with a limited staff. During the year 564 new lantern slides have been filed, catalogue cards having been typed for 363. The record of 732 slides loaned does not give an adequate measure of their circulation or usefulness, as in almost every case each collection illustrates several lectures before being returned to the library.

Among the recent notable acquisitions in the library are the following:

- France, Service de la carte géologique, Mémoire, Le Jura, par Emm. de Margerie. Texte et Atlas.
- Padua, Memorie dell'Istituto Geologico della R. Univ. di Padova, vols. 2-6, 1913-1922.
- Deutsche Geologische Gesellschaft, Zeitschrift, vols. 67-74, 1915-1922.
- Dansk Geologisk Forening, Meddelelser, 1894-1923.
- Yorkshire Geological Society, Proceedings, 1842-1870, 1871-1923.
- Madrid, Comision de Investigaciones Paleontologicas y Prehistoricas, Memorias, No. 1, 1915—date; Notas, No. 1-16, 1915-1918.
- Handlirsch, Fossilen Insekten, 2 vols., 1908.
- New York Historical Society Collections, 7 vols., 1917-1923.
- Zoologischer Anzeiger, 1891-1895.
- Zoologica Danica, 12 parts, 1878-1907.
- Fauna, Arctica, by Roemer and Schaudin, vols. 1-4.
- Zoologiska Bidrag fran Upsala, vols. 1-7, 1911-1921.
- Botanical Survey of South Africa, Memoirs.
- Agardh, Species genera et ordines Algarum, 3 vols., 1848-1876.
- Helsingfors, Societas pro Fauna et Flora Fennica, Acta, vols. 1-44, 1875-1919; Notiser, Nos. 6-11, 1865-1875; Meddelanden, vols. 1-45, 1876-1919.
- Oslo, Videnskabs Selskabets, Forhandlingar, 1865-1920.

VICTORIA MEMORIAL MUSEUM

William McInnes, Director

The chiefs of the two main divisions of the Museum, Mr. R. M. Anderson for biology and Mr. E. Sapir for anthropology, give somewhat detailed accounts of the work of the two divisions in later pages. Mr. Anderson, besides attending to the administration of the division and to the editing of the Arctic reports that were issued during the year, was able to carry out a programme of field work in zoology in Gaspé. Mr. Taverner completed most of the text of the "Birds of Western Canada" which it is proposed to issue as a companion volume to the "Birds of Eastern Canada." Major Allan Brooks of British Columbia, the well known painter of birds, will furnish a set of coloured drawings for the colour plates that will without doubt add very much to the value and interest of the publication. Mr. Malte continued field work in botany in Ontario and Quebec, in the vicinity of Ottawa; and important work was accomplished by the staff, which is detailed by Mr. Anderson.

In anthropology, six field investigations in ethnology and archæology are referred to at some length by Mr. Sapir. Through the kindness of the Department of Indian Affairs, a notable addition was made to the ethnological collections of the Museum, including a set of twenty-one coppers from Alert bay, that is probably unique.

MUSEUM LECTURE HALL

About one hundred meetings and lectures under the auspices of various scientific and educational institutions, including the Royal Society of Canada, were held in the lecture hall, in addition to those in the regular courses of the Museum, which were given on Saturday mornings for children and on the following Wednesday evenings for adults. The programme for this year, which was carried out under the supervision of D. B. Dowling and Harlan I. Smith, embraced:

What Animals Eat, by Clyde L. Patch, Dec. 1 and Dec. 5, 1923.
Indians of Vancouver Island, by E. Sapir, Dec. 8 and Dec. 12, 1923.
Gaspé Peninsula, by F. J. Alcock, Dec. 15 and Dec. 19, 1923.
Canada's Far Northwest, by Fred V. Seibert, Dec. 22 and Dec. 26, 1923.
Canada's Bird Life, by Hoyes Lloyd, Dec. 29, 1923, and Jan. 2, 1924.
The Beginnings of Handicrafts, by Harlan I. Smith, Jan. 5 and Jan. 9, 1924.
The Search for Oil, by G. S. Hume, Jan. 12 and Jan. 16, 1924.
Horses and Their Relations, by Charles N. Sternberg, Jan. 19 and Jan. 23, 1924.
Northwestern Quebec, by W. F. James, Jan. 26 and Jan. 30, 1924.
Experiences in India, by B. R. MacKay, Feb. 2 and Feb. 6, 1924.
How Explorers Travel, by A. C. T. Sheppard, Feb. 9 and Feb. 13, 1924.
Indian Wisdom, by C. M. Barbeau, Feb. 16 and Feb. 20, 1924.
Maps That Are Different, by E. E. Freeland, Feb. 23 and Feb. 27, 1924.
Some Interesting Features of Our Peat Bogs, by A. Anrep, March 1 and March 5, 1924.

These lectures are supplementary to school work in geography and nature study. They deal with the natural resources of Canada, and each is given by a lecturer from his own experience.

As in previous years the lectures for children were particularly successful and in many cases the lecture had to be repeated three times in one morning in order not to disappoint the waiting crowd of eager children; and, in answer to requests from societies in Ottawa and neighbouring towns, many of the lectures were repeated in outside halls.

ANTHROPOLOGICAL DIVISION

ETHNOLOGY AND LINGUISTICS

Exhibits and Research

E. Sapir, Chief of the Division, reports:

The anthropological exhibits in the Victoria Memorial Museum have been added to, and the Eskimo and Eastern Woodland sections rearranged and relabelled. The West Coast collections are also being worked over and rearranged in the exhibition cases. Dr. Henry M. Ami's loan collection of French prehistoric archæology is now exhibited in the first of the two Anthropological Halls of the Museum.

Six scientific field trips were undertaken in the course of the year: a trip by E. Sapir to Camp Red Cloud, Pa., for work on the Kutchin Indian language of Alaska; another by Harlan I. Smith, archæological and ethnological, among the Bella Coola Indians of British Columbia; one by C. M. Barbeau for research among the Gitksan of Skeena river, in British Columbia; one by Diamond Jenness among the Carrier Indians of Bulkley river in British Columbia; the continuation of W. J. Wintenberg's archæological explorations in Ontario; and an ethnological trip by T. F. McIlwraith to the Bella Coola Indians, British Columbia.

Towards the end of the year, J. D. Leechman was appointed museum assistant for the division. O. E. Prud'homme, the artist of the division, continued his work of drawing Nootka masks and designs, a set of Kwakiutl coppers, and various archæological artifacts, and other work required by the division.

E. Sapir spent about two and a half months at Camp Red Cloud, Pa., in a study of two Athabaskan languages—Anvik, spoken near the mouth of Yukon river, and Kutchin, spoken at Fort Yukon, at the confluence of Yukon and Porcupine rivers. This work was made possible by the fact that two Alaskan Indians were employed at the camp. By far the greater part of the season was spent on Kutchin, of which dialect full grammatical data and a series of texts were obtained. In the office Mr. Sapir continued work on comparative Athabaskan linguistics, on Sarcee grammar and the preparation of a series of "Sarcee Texts," and on the "Nootka Texts" begun some time ago. The following linguistic and ethnological papers were published in the course of the year: "An Athabaskan Type of Relative" (International Journal of American Linguistics, vol. 2, January, 1923, pp. 136-142); "The Phonetics of Haida" (International Journal of American Linguistics, vol. 2, January, 1923, pp. 143-158); "The Algonkin Affinity of Yurok and Wiyot Kinship Terms" (Journal de la Société des Américanistes de Paris, vol. XV, 1923, pp. 36-74); "A Note on Sarcee Pottery" (American Anthropologist, N.S., vol. 25, April-June, 1923, pp. 247-253); "The Grammarian and His Language" (The American Mercury, vol. 1, Feb., 1924, pp. 149-155); "Text Analyses of Three Yana Dialects" (University of California Publications in American Archæology and Ethnology, vol. XX, 1923, pp. 263-294).

Harlan I. Smith spent the summer season in the Bella Coola Indian area, continuing the combined archæological and technological work of his previous trips. Supplementary Bella Coola and Carrier specimens were obtained and numerous photographs taken. In the office Mr. Smith continued his work on reports upon the material culture, past and present, of the Bella Coola and Carrier Indians.

C. Marius Barbeau continued his investigations among the Gitksan tribes of Skeena river, in British Columbia, spending the months of July and August

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at the Indian villages of Gitwanga and Gitsegukla. He also incidentally collected, while in Hazelton, some Sekanais and Carrier traditions, and observed the *potlatch* and secret society ceremonials that were held in July among the Carriers of Hagwelgate. A visit to the Kootenays of St. Eugene and of Fairmont Springs, and a short stay at Morley reserve, Alberta, in September, also gave him an opportunity to make a rapid survey of these tribes and collect a set of traditional accounts, particularly at Morley. In the office Mr. Barbeau completed his manuscript of "Indian Days in the Canadian Rockies," which was later issued by the Macmillan Company of Canada (207 pp., ill.). Various articles, entitled: "The Gaspé Fisher-folk" (The Quebec Daily Telegraph, Christmas, 1923); "Fort Simpson, on the West Coast" (The Canadian Historical Association, Annual Report, 1924); "The Salmon Run on the Upper Skeena" (Forest and Outdoors, March, 1924); "An Artist among the Northwest Coast Indians" (Arts and Decoration, May, 1923); and "Les chants populaires du Canada" (Revue de L'Amérique latine, Fev. 1924); have appeared in the course of the year. Mr. Barbeau has also prepared a report accompanied with photographs for the Dominion Parks Branch, on the Indian legendary site of "Temlaham," in northern British Columbia, which may be established into a federal park and a game preserve.

D. Jenness, in April and May, reorganized the Eskimo cases in the main Anthropological Hall of the Museum, and arranged a small exhibit for the Northwest Territories Branch of the Department of the Interior. During the summer he supervised the publication of his report on the "Physical Characteristics of the Copper Eskimos" and finished two other reports in the Canadian Arctic Expedition series: "Eskimo Mythology" and "Eskimo String Figures," both of which are now in the press. He examined, in August, a number of unpublished manuscripts in the Dominion Archives relating to the early history of the Indians of the Mackenzie River valley and northern British Columbia, and at the same time resumed work on another Arctic Expedition report, "Eskimo Music and Songs," which he completed in February while in the field, and sent in for publication. He left early in October for Hazelton, British Columbia, to carry out researches among the western branch of the Carrier Indians resident in that vicinity. On closing up this work at the end of February he made a trip 70 miles north, to examine the ancient Indian village at Old Kuldo, along the Yukon telegraph line. He then went to Vancouver, to gather an outfit for his field work during the coming spring and summer, and at the same time to make some researches into the language of the Kaska Indians of upper Stikine and Liard rivers, with the aid of an informant now resident in Vancouver. Mr. Jenness has also published an article entitled "Origin of the Copper Eskimos and Their Copper Culture" in The Geographical Review (vol. XIII, October, 1923, pp. 540-551).

F. W. Waugh spent much of his time in the arrangement of Iroquois mythological and literary materials. He also prepared a paper for the Department of the Interior on the birds and mammals of Labrador, based on notes taken in the field in 1921-22.

T. F. McIlwraith spent six months, from September, 1923, to March, 1924, continuing his investigations of the Bella Coola Indians. Using the previous year's work as a basis, he was able to obtain a detailed account of the complicated religious and social life of these people. It was found that these two subjects were closely linked to form an exceedingly complex culture based on jealously guarded family traditions. Mr. McIlwraith was present at the ceremonial dances held during the winter and was able to obtain a large amount of material on this subject, especially with regard to the psychological effect on those taking part. Further information was gained on chieftainship, land

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tenure, government, magic, and mythology, adding to, and confirming, his previous year's results. With a recording phonograph Mr. McIlwraith collected more than one hundred Bella Coola songs, complete with texts. Specimens for the Museum were also purchased.

"An Album of Prehistoric Canadian Art" (195 pp.) by Harlan I. Smith has appeared as Bulletin No. 37 in the Anthropological Series (No. 8) of the Victoria Memorial Museum. A monograph entitled "The Malecite Indians, with Notes on the Micmas," by Wm. Hubbs Mechling (394 MSS pages, XIX plates, and some photographs) has been submitted for publication as a memoir of the Anthropological Series. Some data collected among the Canadian Sioux by W. D. Wallis were published under the title of "Beliefs and Tales of the Canadian Dakota" in The Journal of American Folk-Lore, No. 139 (Jan.-March, 1923, pp. 36-101).

Ethnological manuscripts secured during the year include:

From George Hunt, Port Hardy, B.C.:

119 handwritten pages of notes on 21 coppers from Alert bay.

From T. F. McIlwraith:

730 typewritten pages of notes on the Bella Coola Indians, Bella Coola, B.C.

From Miss Helen Roberts:

Musical transcriptions of 100 Nootka songs collected by E. Sapir.

Musical transcriptions of Diamond Jenness' Eskimo songs, incorporated in his report on "Eskimo Music and Songs."

Accessions

Accessions of Ethnological Specimens

Specimens collected in the course of field work by members of the Division of Anthropology include:

By Harlan I. Smith:

41 Bella Coola specimens from Bella Coola, B.C.

7 Bellabella specimens from British Columbia.

11 Carrier specimens from Bella Coola, B.C.

By C. M. Barbeau:

55 Tsimshian specimens from the Upper Skeena country, B.C.

4 Carrier specimens, from Hagwelgate, B.C.

1 Kootenay specimen, from Sinclair canyon (Vermilion springs), B.C.

By F. W. Waugh:

3 Iroquois specimens.

There have been received as gifts:

From the Department of Indian Affairs:

342 specimens, potlatch paraphernalia surrendered by the Alert Bay Indians.

From F. G. Speck:

Specimens of Mohegan aboriginal corn, still cultivated by the Mohegans of Connecticut for making succotash and to be parched and beaten in wooden mortar for corn flour.

From the Royal Canadian Mounted Police:

97 Eskimo archæological specimens from Ellesmere island.

From C. M. Barbeau:

1 rabbit-skin mat from Hagwelgate, B.C.

1 cedar mat from Hazelton, B.C.

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There have been acquired by purchase:

From Captain J. Bernard:

33 Eskimo and Chukchee ethnological and archæological objects.

By purchase or gift through J. D. Soper for the Museum:

38 Central Eskimo specimens from Ponds inlet (some of these are due to the courtesy of the Royal Canadian Mounted Police, Mr. W. G. McGregor, Sgt. Joy, and Corp. McInnes).

Transfers and Gifts of Ethnological Specimens

10 Kwakiutl specimens to the Department of Indian Affairs, Ottawa (Dr. D. C. Scott).

108 Kwakiutl specimens to the Royal Ontario Museum, Toronto (Dr. C. T. Currelly).

Accessions of Phonographic Records

Records taken by officials connected with the Division of Anthropology:

By E. Sapir:

18 records of Kutchin, from Fort Yukon, Alaska.

By T. F. McIlwraith:

58 Bella Coola song records including 118 songs from Bella Coola, B.C.

Photographic Work

Ethnological photographs taken or collected for the Museum by officers connected with the Division of Anthropology:

By E. Sapir:

2 Kutchin photographs from Alaska.

1 Teton Sioux photograph.

By C. M. Barbeau:

500, or over, photographs of the Skeena River Gitksan, of the Carriers of Hegwewl-gate, and of the Stoney and Kootenay Indian country.

Purchased or borrowed for reproduction (by C. M. Barbeau):

13 Stoney photographs from Banff, Alberta.

3 Carrier photographs from Hazelton, B.C.

10 Kootenay photographs from British Columbia.

19 Tsimshian photographs from Hazelton, B.C.

25 Nootka photographs from N. K. Luxton, Banff, Alberta.

1 Salish photograph from Fraser river, B.C.

By D. Jenness:

27 Carrier photographs from Hagwelgate, B.C.

33 Tsimshian photographs from Hazelton, B.C.

By J. D. Leechman:

1 West Coast photograph from near Stanley park, Vancouver, B.C.

By Photographic Division:

4 photographs of Dr. H. Ami's exhibit of European prehistory, rotunda of Museum.

There have been received as gifts from individuals not connected with the Division of Anthropology:

From Iver Fougner, Bella Coola, B.C.:

4 Bellabella photographs from Bella Coola, B.C.

From F. K. Bennett, Ocean Falls, B.C.:

1 Bellabella photograph from Ellersley channel, B.C.

There have been purchased:

93 photographs of Paul Kane's paintings of Indians from various parts of Canada.

Lantern slides made in the course of the year by the Photographic Division for the Division of Anthropology include:

273 slides illustrating Naskopi, Eskimo, Bella Coola, Gitksan, Carrier, and Sarcee ethnology.

FOLK-LORE

C. Marius Barbeau, Ethnologist, reports:

No subsidized research on folk-lore has been undertaken during the past year. The volume prepared in collaboration by Mr. Barbeau and Mr. Sapir, entitled "Folk Songs of French Canada" (260 typewritten manuscript pages, and 41 melodies), has been completed. A fourth series of Canadian folk-tales from Quebec, edited by Mr. Gustave Lanctot, is being issued in *The Journal of American Folk-Lore*, July, 1923.

Folk-lore Collections

(French)

The Massicotte (E.Z.) Collection:

254 photographs of people and technology from the neighbourhood of Montreal; 160 of these are of old wooden crosses of the western parts of Quebec.

93 song texts, principally from Narcisse Primeau, Saint-Urbain (Chateauguay).

61 song melodies noted down by N. Primeau.

1 Folk-tale.

A manuscript on the Canadian Sash ("La Ceinture fléchée").

The Lambert (Adélard) Collection:

32 song texts.

32 song melodies recorded on the phonograph.

The Barbeau (C. Marius) Collection:

5 song texts.

46 old photographs and daguerreotypes from the neighbourhood of Quebec, and of Montebello (Labelle county).

Approximate totals (1914-1924):

5,203 song texts, not including those found in manuscript books, in clippings from old newspapers and other sources.

3,534 song melodies, recorded on the phonograph.

358 song melodies, recorded by ear.

309 folk-tales.

177 anecdotes.

2,235 photographs.

105 dance melodies, most of which were recorded on the phonograph.

A considerable collection of rhymes, formulæ, sayings, and beliefs.

Also abundant data on Canadian folk-technology.

(German Canadian)

The Wintenberg (W. J.) Collection:

Manuscript including 134 typewritten pages of folk-lore data collected in the old German settlements of Ontario.

(Specimens)

3 Canadian sashes ("ceintures fléchées") purchased by E. Z. Massicotte for the Victoria Museum.

1 Canadian sash (Hudson bay) presented by Mr. William McInnes.

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ARCILEOLOGY

Harlan I. Smith, Archæologist, reports:

The archæological exhibits have remained open to the public during the year.

Accessions

The accessions to the archæological collections are as follows:

Collected by Officers of the Division

Accessions 275, 281, 283, and 284. Archæological material.

From Nottawasaga township, Simcoe county, Collingwood township, Grey county, and the Lawson village site, Middlesex county, Ontario. Collected by W. J. Wintemberg.

Accession 287. Archæological specimens. From the coast of British Columbia. Collected by Harlan I. Smith.

Gifts

Accession 269. Grooved hammer. From surface near Iddesleigh, Alberta. Collected by Charles M. Sternberg.

Accession 270. Pottery and chert chips. From point Pelee, Essex county, Ontario. Presented by Hoyes Lloyd, Canadian National Parks Branch, Department of the Interior, Ottawa.

Accession 271. Archæological material. From Nottawasaga township, Simcoe county, Ontario. Presented by Mackenzie Matchett, Creemore, Ontario.

Accession 272. Stone celt. From Nottawasaga township, Simcoe county, Ontario. Presented by William Whitley, Creemore, Ontario.

Accession 273. Fragments of earthenware pipes and brass pendant. From Nottawasaga township, Simcoe county, Ontario. Presented by Wellington Morrison, Creemore, Ontario.

Accession 274. Fragment of earthenware pipe. From Mulmur township, Dufferin county, Ontario. Presented by David Somerville, Banda, Ontario.

Accession 276. One stone and two earthenware pipes. From Collingwood township, Grey county, Ontario. Presented by John Bailey, Collingwood, Ontario.

Accession 277. One earthenware and two stone pipes. From Collingwood township, Grey county, Ontario. Presented by Mrs. Janet McMurchy, Collingwood, Ontario.

Accession 278. One earthenware pipe. From Collingwood township, Grey county, Ontario. Presented by Godfrey McAllister, Collingwood, Ontario.

Accession 279. Archæological material. From Nottawasaga township, Simcoe county, Ontario. Presented by John Currie, Collingwood, Ontario.

Accession 280. Archæological material. From Nottawasaga township, Simcoe county, Ontario. Presented by George Montgomery, Collingwood, Ontario.

Accession 282. Earthenware pipe. From Nottawasaga township, Simcoe county, Ontario. Presented by Hugh Campbell, Duntroon, Ontario.

Accession 285. Stone with incised design. From Lawson village site, Middlesex county, Ontario. Presented by John Middlebrook, St. James park, London, Ontario.

Accession 286. Fragments of pottery. From Gran Quivera, New Mexico. Presented by Dr. Cornelia G. Harcum, Royal Ontario Museum of Archæology, Toronto, Canada.

Accession 288. Celt. From surface of beach, Whytecliff, near point Atkinson, near Vancouver, B.C. Collected and presented by W. H. Carter, Geological Survey, Pacific building, Vancouver, B.C.

Accession 289. Worked ocean shell. From Nottawasaga township, Simcoe county, Ontario. Presented by William Anderson, Creemore, Ontario.

Accession 290. Archæological specimens. From the coast of British Columbia. Presented by F. K. Bennett, Ocean Falls, B.C.

Accession 291. Celt made of stone. From Hope Flat, B.C. Presented by T. S. Thacker, Hope, B.C.

Accession 292. Archæological specimens. From British Columbia. Presented by T. L. Thacker, Hope, B.C.

Accession 293. Scraper chipped from quartzite. Presented by J. L. Thacker, Hope, B.C.

Accession 294. Archæological specimens and maps. From British Columbia. Presented by J. D. Leechman, room 25, 1116 Broad street, Victoria, B.C.

Field Work

Archæological exploration was carried on in British Columbia by Harlan I. Smith, and in Ontario by W. J. Wintemberg.

British Columbia. Archæological exploration in British Columbia was conducted by Mr. Smith, especially in the Bella Coola valley, on Dean channel, and on South Bentinck arm, in continuation of the work of the past three field seasons; and in the vicinity of Hope, Vancouver, and Victoria.

The petroglyphs opposite the mouth of Noosatsum river, reported by Indians, were located, and a tracing, a plaster of Paris mould, and photographs, were made of them. The petroglyphs on the rock shelf west of the falls, 2 miles south of Bella Coola, were revisited, and photographed. Plaster of Paris moulds were made of all the figures not taken before. The petroglyphs at the mouth of Swallow creek, on the east side of Dean channel, were also located. One was traced and some were photographed. All should be traced, moulded, and photographed. A pictograph in red was discovered on the little bay north of the long point projecting into the east side of Labouchère channel. This was photographed, as were also the red pictographs about a mile north of Mesatchie head. The petroglyphs on the south side of the mouth of Noeick river, on South Bentinck arm, reported by Indians, were located, photographed, and traced.

Near Hope, sites of semi-subterranean houses were examined. In this Mr. T. L. Thacker kindly assisted. He also presented a collection of specimens from the vicinity.

A sculptured human form representing a humpback, found in a shell-heap, on Fraser delta about 20 miles south of Vancouver, was secured from its Indian owner. It is the largest unbroken stone sculpture of the human form known from Canada. Mr. Ralph L. Roys gave assistance in the work around Vancouver.

Unidentified markings were reported on Aldridge point about 20 miles west of Victoria by Mr. Allen Ford and Mr. C. C. Pemberton of Victoria. These were visited and found to be petroglyphs and so far as known the nearest to Victoria. All the petroglyphs and pictographs above mentioned are worthy of preservation as historic monuments.

Ontario. Mr. Wintemberg made an archæological reconnaissance, lasting two months, from Tottenham, in the southern part of Simcoe county, to cape Clear, in the northern part of Grey county, and secured many specimens. Thirty-seven of the sites found were Tobacco Nation, but four were Huron and two were Algonkian. Thirty-two of the Tobacco Nation sites and two Huron sites are post-European, but five of the Tobacco Nation sites, two of the Huron sites, and the Algonkian sites, are pre-European. Ossuaries were found at most of the Tobacco Nation sites, but only two of them were undisturbed.

Notes and drawings were made of specimens in the Museum of the Huron Institute, Collingwood, in the collection of the Women's Institute in the Public Library, Penetanguishene, and in private collections near cape Clear, at Meaford, and near Collingwood.

The exploration of the Lawson village site, near London, begun in 1921, was completed.

Office Work

Lectures on primitive industries were delivered in Ottawa, and on archæology as an aid to Canadian trade, in Ottawa, West Summerland, Victoria, and Hope.

Mr. Wintemberg made a study of the pottery from the prehistoric Iroquoian site at Roebuck, Ontario, and wrote articles on "Unusual Stone Artifacts from Ontario," "Cowry Shells from Archæological Sites in Ontario," and "Certain Eye Designs on Archæological Artifacts from North America." The last was published in the Transactions of the Royal Society of Canada for 1923. He

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also completed his report on "The Uren Village Site, Oxford County, Ontario," and made the drawings for its illustration.

Mr. G. E. Rhoades, for the purpose of studying archæology, ethnology, and museum methods, gave a part of his time as assistant during the year. He made a study of the torsion of femora, and its effect on the length of the bone of thirty-one individuals from the prehistoric Iroquoian site near Roebuck, Ontario. Deformation predominated in the right leg. The deformed femur was shorter than its normal mate. The tibia of a deformed leg tended to be longer than that of the normal, thus adjusting the tendency of the deformed leg to be shorter than the normal. A study of the humeri suggested that the deformity generally affected an individual according as he was right or left handed.

BIOLOGICAL DIVISION

R. M. Anderson, Chief of the Division, reports:

Since April, 1922, some progress has been made in the preparation of exhibits for the Museum halls, although delay and congestion have been caused in the preparatory sections on account of the lack of proper exhibition cases. One large, new, glass and mahogany exhibition case, constructed as a sample on the unit plan in the Museum shops, has recently been installed as a model for the systematic collection of mounted birds and single specimens or small habitat groups of the Canadian species of Diving Birds and Long-winged Swimmers put on exhibition. Considerable experimentation has been made in the designing of informative and attractive labels and a beginning has been made on the systematic labelling of the mounted material in the Museum. Sufficient cases for the east Zoological Hall have been ordered and it is intended to carry the system to completion as rapidly as possible with the birds and small mammals of Canada, making the Museum more interesting and instructive to the general public. While the study and reserve series of specimens in the Museum have always been available to qualified students and are often consulted, having a fairly complete and comprehensively labelled exhibition open to the public will mean a considerable saving of time to members of the technical staff and give them opportunity to put more time on necessary research work.

Many specimens of mammals, birds, reptiles, batrachians, and plants have been sent in for determination from different parts of the country and numerous requests for information from different departments of the Government and from the general public have been answered by officers of the division. Numerous specimens have been loaned to schools for the illustration of natural history work, and selected lantern slides for natural history lectures have been loaned extensively to persons engaged in educational or wild life protection and conservation work. Loans of special groups of animals and plants have also been made to museums and other institutions where specialists have been preparing technical monographs of certain groups.

R. M. Anderson, zoologist (mammalia), Chief of the Biological Division, devoted considerable time to the administrative work and correspondence of the division and to the identification and study of the mammal collections. Many additions were made to the card catalogue records of bibliography of Canadian mammals and field notes on the distribution, habits, and ecology of the different species of Canadian mammals. Some time was devoted to editing and proofreading the scientific reports of the Canadian Arctic Expedition, 1913-18, as general editor of these reports for the Arctic Publications Committee. He also represented the Department of Mines on the Advisory Board on wild life protection, and as Canadian member of the Board of Directors of the American Society of Mammalogists attended the fifth annual stated

meeting of the society in the Academy of Natural Sciences, Philadelphia, May 15 to 17, 1923. Leaving Ottawa on August 30, 1923, he proceeded to Grand Cascadepia, Quebec, with the intention of spending some time with geological and topographical survey parties in Shickshock mountains, continuing a biological reconnaissance begun the season before. On account of unusually favourable weather, the geological and topographical parties left that region earlier than was expected and he carried on work with a local assistant in the interior of Gaspé peninsula until October 12. A short time was spent at the Federal Zinc and Lead Company's property at about 1,800 feet elevation in Lemieux township, Gaspé county. From thence he proceeded over Lake Ste. Anne portage and collected for some time on the west branch of Ste. Anne river, after which he packed up the northeast branch of Ste. Anne river to Lac aux Américains, and over Tabletop range and mount Richardson, all in Gaspé county, collecting specimens en route. The latter part of September and the early part of October were spent in collecting on Berry Mountain brook and near the forks of the Cascapedia, in Matane county. Forty birds were collected and seventy-two mammals, ranging in size from moose to pigmy shrew, as well as a few plants. The fauna and flora of this region are interesting because from an isolated region of ancient topography, containing little islands of Arctic-alpine conditions at from 3,500 to 4,500 feet elevation, surrounded by dense, primeval forests of the Hudsonian life zone. Three lectures were given in Ottawa during the winter on topics connected with northern Canada.

P. A. Taverner, ornithologist, worked steadily on the manuscript of "The Birds of Western Canada," a complementary volume to the "Birds of Eastern Canada," and did not go to the field. The manuscript is practically ready for the printer and will appear some time during the coming year. The coloured pictures for this work, one hundred in number, have been made by Major Allan Brooks, D.S.O., of Okanagan Landing, B.C., and reach a very high standard of excellence. Mr. Taverner has also been engaged on a "Manual of the Birds of the Canadian Atlantic," to be published under the auspices of the Biological Board of Canada.

Mr. C. H. Young, senior collector-preparator, spent the season from May 15 to September 27 in Waterton Lakes park, Alberta, making a general biological collection. An unfortunate accident on the latter date put an end to his work and caused a premature return to Ottawa. He brought with him his usual collection of beautifully prepared specimens.

The services of J. Dewey Soper of Edmonton, Alberta, were secured as naturalist (junior zoologist) to accompany the judicial and supply expedition under command of J. D. Craig to the eastern Arctic islands on D. G. S. *Arctic*. The expedition proceeded up the western coast of Greenland to Disko and Etah, then crossed Smith sound and proceeded down the east coast of Ellesmere island to Craig harbour, North Devon, Lancaster sound, Ponds inlet, and Cumberland sound, Baffin island. He had numerous opportunities of collecting, which though of short duration he used to most excellent advantage. Besides interesting collections in zoology, botany, anthropology, archæology, and geology, he brought back much information as to biological conditions and reported favourably on the practicability of a small expedition wintering at the posts of the Royal Canadian Mounted Police or Hudson's Bay Company on Cumberland sound and making an exploratory trip in early spring in to Nettilling and Amadjuak lakes to investigate the supposed nesting grounds of the Blue Goose, which are at present unknown, and are attracting considerable attention from zoologists and game conservationists.

A steady stream of donations have come in from various sources through the year. Among those to whom special thanks are due are: The Canadian

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National Parks Branch of the Department of the Interior; The Royal Canadian Mounted Police; The Colorado Museum of Natural History, Denver, Colorado; Frank Farley, Camrose, Alberta; P. B. Philipp, New York City; Ernest Thompson Seton, Greenwich, Connecticut; Dr. M. Y. Williams, Vancouver, and many others.

The loan lantern slide distribution has fallen off somewhat during the past year, owing largely to the Migratory Birds Division of the Parks Branch having engaged in similar work and being able to furnish lecturers as well as slides, so that the field has been divided. As originals for much of their slide and lecture material come from this division, this only enlarges our real sphere of usefulness in this direction. During the year there has been loaned outside of the city, and largely outside of the province, some nineteen collections of slides, reaching a total audience of about 3,000.

Accessions in ornithological collections:

Birds..	380
Nests and eggs..	13
Accessions to mammal collections..	296

The following work was done in the preparatory department of the Museum by Clyde L. Patch, chief taxidermist and herpetologist; Claude E. Johnson, artist; D. Blakely, taxidermist; Jos. Rochon, osteological preparator; J. E. Perron, museum helper (tanner); and D. MacDonald, museum assistant:

Mammal and bird skins prepared for scientific study.....	165
Mammals, birds, and reptiles prepared for exhibition.....	40
Large mammal skins tanned (moose, caribou, bear, fox, mountain lion, deer, seal, buffalo).....	38
Plaster reproductions (human skulls, ethnological specimens), reliefs, cast and coloured.	10
Numerous cast and coloured leaves, grass, and fish in wax; plaster exhibition bases; material for four bird groups collected.	
Lantern slides and maps coloured.....	65
Colour plates, line and wash drawings, lettered and coloured labels, photos retouched.	51
Complete skeletons collected.	17
Separate skulls collected.....	17
Skeletons macerated.	12
Skeletons prepared for mounting.	7
Skeletons mounted.	4
Skulls cleaned, about.....	200
Various skeletons repaired and cleaned.	

Attention has been given to the securing and uniform filing of data relating to Canadian herpetology. Some time has also been devoted to enlarging the Museum's collection of Canadian amphibians and reptiles by encouraging contributions and by making exchanges with other institutions.

New accessions of reptiles and amphibians, and localities from which they were received:

	Specimens
American Museum of Natural History, New York.....	8
R. M. Anderson, Gaspé county, Quebec.....	2
D. Blakely, Moose Creek, Ontario.....	6
J. Roland Brown, Hamilton, Ontario.....	6
E. R. Buckell, Penticton, B.C.....	16
Oscar Carter, Ottawa, Ontario.....	1
Norman Criddle, Treesbank, Manitoba.....	3
R. S. Finnie, Burlington, Vermont.....	1
F. Johansen, Tenaga, Quebec.....	56
C. E. Johnson, St. Thomas, Ontario.....	4
E. M. Kindle, northern Ontario.....	2
Hamilton M. Laing, Okanagan Landing, B.C.....	1
R. O. Merriman, Hamilton, Ontario.....	29

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	Specimens
L. Morrisset, Ottawa, Ontario.....	1
J. A. Munro, Oak Bay, B.C.....	2
W. S. Odell, Honey Harbour, Ontario.....	1
C. L. Patch, Ottawa, Ontario.....	11
Hugh J. Reid, Winnipegosis, Manitoba.....	2
G. E. Rhoades, Ottawa, Ontario.....	2
Harlan I. Smith, Bella Coola, B.C.....	8
Charleston, South Carolina.....	2
C. M. Sternberg, Munson, Alberta.....	4
D. A. Stewart, Ninette, Manitoba.....	56
T. L. Thacker, Hope, B.C.....	14
J. Vicars, southern Alberta.....	2
F. W. Waugh, Fitzroy Harbour, Ontario.....	22
Geo. White, Buckingham, Quebec.....	11

M. O. Malte, Chief Botanist of the National Herbarium, was engaged, from early spring to late autumn, in the study of the flora of the Ottawa district. About 2,900 herbarium specimens, representing over 700 species and varieties, were secured. From June to September he was aided by H. A. Quackenbush as temporary field assistant. These collections, together with those made last year and previously to that by the late Professor John Macoun and the late James M. Macoun, will enable the botanical office to prepare, in the near future, a comprehensive report of the flora of the Ottawa district, which report, it is hoped, may help materially to stimulate interest in the natural history in general of this very interesting district.

After the return from field work, considerable time was spent in determining plant collections sent in from colleges, other institutions, and private collectors. Attention was also given to editing of botanical reports of the Canadian Arctic Expedition, 1913-18, of which one was issued during the year 1923, viz.:

"Report of the Canadian Arctic Expedition, 1913-18," volume IV, Botany, part C, Fungi, by John Dearnness, pp. 1-24.

Two other reports, one on lichens, by G. K. Merrill, and one entitled "General Notes on Arctic Vegetation," by F. Johansen, were made ready for the press.

In this connexion it may be mentioned that the botanical office instructed members of the Canadian Arctic Expedition of 1923 in the art of plant collecting and supplied them with adequate plant preservation material. A magnificent collection of well-preserved plants was brought back by J. D. Soper, and a smaller collection was received from Messrs. B. C. Jakeman and L. Fielder of the Royal Canadian Mounted Police posts in Ellesmere and Baffin islands.

Plants received, outside of collections made by staff:

Miss Alice Eastwood, Berkeley, California.....	237
A. H. Brinkman, Craigmyle, Alberta.....	5
H. Mousley, Hatley, Quebec.....	47
E. M. Gress, Harrisburg, Pennsylvania.....	12
Fr. M. Victoria, Montreal, Quebec.....	25
M. S. Baxter, Rochester, N.Y.....	34
British Museum (Shackleton-Rowett expedition).....	8
C. F. Newcombe, Victoria, B.C.....	2
Morten P. Porsild, Disko, Greenland.....	192
Ontario Agricultural College, Guelph, Ont.....	6
W. R. McColl, Owen Sound, Ontario.....	65
J. D. Soper (Canadian Arctic Expedition, 1923).....	545
B.C. Jakeman and L. Fielder, R.C.M.P.....	34
J. Russell, Dept. of the Interior, Ottawa.....	12
Norman Criddle, Treesbank, Manitoba.....	3
Carleton R. Ball, Washington, D.C.....	28
R. M. Anderson, Ottawa.....	15
Harlan I. Smith, Ottawa.....	4
Total.....	1,274

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At the end of the fiscal year the number of mounted and numbered sheets in the National Herbarium was about 111,900, an increase of nearly 7,000 from the end of the last fiscal year.

Specimens of mammals were received by gift during the year as follows:

Canadian National parks, Wainwright, Alberta, mule deer.

Harry Borland, Peterborough, Ontario, two black squirrels.

Maxwell Graham, Northwest Territories and Yukon Branch, 9 skulls of reindeer.

Northwest Territories and Yukon Branch, 1 silver fox and 1 cross fox.

M. Barbeau, 1 little brown bat.

Ernst Antevs, 1 little brown bat.

Information having been received that the Canadian Government mine-sweeper *Thiepval* had been commissioned to lay down stores at numerous points on the coast of British Columbia, southeastern Alaska, Aleutian islands, Kamchatka and Kuril islands, in preparation for the British round-the-world flight, arrangements were made through the courtesy of the Director of the Naval Services, for the Victoria Memorial Museum to send a trained naturalist to accompany the expedition, and Hamilton M. Laing, of Comox, B.C., was engaged for the service. The vessel left Victoria February 29 for a cruise of approximately three months. Opportunity is seldom offered to a naturalist to reach some of these unfrequented islands and it is expected that the Museum will be enriched by a valuable series of the pelagic birds of the north Pacific, which are needed to complete its collections.

MINES BRANCH

John McLeish, Director

Although no major change was made in the Mines Branch organization during the year a number of promotions effected and new appointments made materially increased the capacity of the Branch in carrying out its basic function, viz., the collection of information and the conduct of investigations to promote the efficient development and utilization of mineral resources. Six vacancies on the senior technical staff were filled by promotion. Twelve vacancies, of which eight were engineering or chemical positions, one laboratory assistant, and one clerk, were filled by advertisement and open competition. Five temporary appointments were made during the year. Separations from the staff included one chemist resigned from the permanent staff, five temporaries, and the loss by death of W. Marsh, night watchman, and R. Turner, laboratory assistant.

Promotions and appointments represented a turn over in duties of over 30 per cent of the technical staff. Adjustment to new conditions in undertaking investigative and research work takes a long time, and some years will pass before substantial results can be expected. During that period it seems certain that a continuation of staff turnover may be expected.

The function and organization of the Mines Branch have been described in some detail in the reports of the two preceding years. The extent to which the present organization is able to cover the very broad field of activity open to it is indicated by the following review and it will be apparent that there are many directions in which the work might be extended to the national advantage.

Canada is known to possess enormous mineral resources, yet the annual trade returns show the great extent to which this country has become, and is apparently growing increasingly dependent upon, foreign sources for coal, iron, petroleum, and many other products. Although economic conditions and geographic distribution of resources play an important part in this international trade, nevertheless a greater knowledge of our own resources and of the processes that must be used to recover from them marketable products is essential to secure increased domestic production and to diminish imports. It is equally important that production should be made in a manner and under conditions that will give a maximum recovery of marketable ore, will ensure the conservation of minerals not being immediately exploited, and will afford the maximum protection of health and life amongst those engaged in the industry.

CO-OPERATION WITH OTHER ORGANIZATIONS

The Mines Branch has endeavoured to co-operate to the fullest extent with provincial and other Government departments and with scientific organizations engaged in similar lines of investigations. In this connexion special reference may be made to the Department's representation on the Canadian Exhibition train in France; to co-operation with the Canadian Exhibition Branch in the collection of exhibits, and the preparation of literature, for the British Empire Exhibition at Wembley; to numerous chemical examinations for other departments; to special examinations of hot-water springs for the Parks Branch; to co-operation with provincial highway departments in respect

to investigations of road building materials; to the carrying on of investigations for, and in co-operation with, the Dominion Fuel Board; and to acting as consulting advisors in respect to the investigations of the Lignite Utilization Board.

REVIEW OF ACTIVITIES

The various investigations undertaken during the year are briefly indicated in the following pages. As in the previous year the Director devoted a great deal of time to the work of the Dominion Fuel Board of which he is vice-chairman. He also acted as a member of the Advisory Committee to the Department of the Interior on Mining Regulations. In July a visit was paid to Buffalo and Chicago in connexion with the proposed central heating investigation. In August, accompanied by the secretary of the Dominion Fuel Board, an inspection was made of the principal coal mining districts of the Maritime Provinces. In September and October consultations were held with provincial and university authorities in Saskatchewan and Alberta with a view to securing co-operative action. Field parties in these provinces were visited, and inspections were made of the coal mining in southern Saskatchewan, of the progress made in metallurgical practice at Trail, B.C., and of mining development at Rossland and at Kimberley, B.C. The annual conventions of several engineering societies were also attended. Several contributions were made to the technical press in respect to the general work of the Mines Branch and on certain phases of the Canadian mining industry.

A list of the Mines Branch publications completed and published during the year will be found under the report of the Editorial Division. Attention may, however, be here drawn to the fact that a vast amount of information concerning the mineral resources and mining industries is conveyed to the public through channels other than the published reports. Many papers are prepared by members of the technical staff for presentation at annual meetings of scientific societies and are published in society transactions or in the technical press. A number of shorter articles descriptive of present conditions or recent developments have been specially prepared for distribution to the technical and financial press, both in Canada and in England. But perhaps the greatest amount of information, or at least that which takes the greatest amount of time, is conveyed through correspondence to individual inquirers, or is given personally to those seeking it.

The Chief of the Mineral Resources Division states that nearly one-half of the office time of his technical staff is taken up with answering correspondence. The intelligent preparation of such data for public use requires wide training, long experience, and literary skill. There is great need to strengthen the Mines Branch establishment in this direction in order to give the results of its work more efficient distribution.

MINERAL RESOURCES DIVISION

The Division of Mineral Resources is charged with the investigation of mineral resources and their technology with particular reference to production, treatment, character, uses, distribution of output, market conditions, market requirements, buyers' specifications, prices, trade, home consumption, foreign production, and competition, etc.

The organization of the division was increased during the year by the addition of two grade I engineers, E. H. Wait, appointed June 11, and C. H. Freeman, appointed June 13; and one clerk typist, M. F. Goudge, was appointed as engineer, grade II, on June 9, replacing F. S. MacNiven, resigned.

FIELD INVESTIGATIONS

A. W. G. Wilson, Chief of the Division, visited in July the old oil fields in Gaspé peninsula to secure samples of those oils not previously examined by the Mines Branch. This oil field has not hitherto been considered important, but with the exhaustion of the world's principal oil fields, the smaller areas may eventually become valuable. It was planned to recover old records and other information that might be of value in the future. Mr. Wilson has recommended the preparation of a structural map to give the location of all old wells, and to show geological structures.

In August and part of September inspection trips were made to the bituminous sand areas of the Athabaska, and also to certain of the sodium sulphate deposits of the Prairie Provinces where drilling parties were employed in an examination of these resources.

A special investigation of the technology of arsenic was also undertaken, the field work being done at intervals during the summer. The principal work involved a study of, and collection of information at, plants in Canada and in the United States, where arsenic trioxide is being recovered and refined.

L. H. Cole continued his investigation of the alkaline lakes of western Canada. Two drilling parties, and one topographic party were employed throughout the season. The drilling parties were in charge of H. A. Leverin, and F. M. Goudge. The topographic work and other areal work were performed by temporary assistants under Mr. Cole's direction. This season's work proved up a large additional tonnage of natural Glauber's salt. The total quantity of hydrous sodium sulphate that has been proved to exist in the lakes so far examined is in excess of 50,000,000 tons.

On October 3, at the Annual Western Meeting of the Canadian Institute of Mining and Metallurgy at Estevan, Mr. Cole gave an illustrated descriptive address on the sodium sulphate investigation. Earlier in the year he addressed the Rotary Club at Swift Current on the same subject. In March he presented a paper on sodium and magnesium salts at the Toronto meeting of the Canadian Institute of Mining and Metallurgy, and contributed a paper to the Pulp and Paper Magazine on non-metallic minerals and chemicals used in the pulp and paper industry.

Mr. Cole also undertook the collection, preparation, and shipment of a special exhibit of sodium and magnesium salts for the British Empire Exhibition, Wembley.

H. S. Spence spent a few weeks examining feldspar properties in Lièvre River district, Quebec, and Sudbury district, Ontario. Most of his time has been given to a study of the occurrences and use of bentonite. During the present season about six weeks were spent in a survey of known bentonite deposits in Saskatchewan, Alberta, and British Columbia. This was followed by visits to similar deposits in the United States, and by an inquiry into production, markets, and uses. Mr. Spence reports that there are indications that this material will ultimately become of considerable economic importance, although at present the interest of industrial concerns in this mineral product is rather light.

S. C. Ells has been engaged for a number of years in the investigation of the bituminous sand resources of Athabaska river. Field surveys were carried on from early in February to the end of October. The topographical survey has now been completed. The area thus mapped comprises approximately 1,160 square miles. On the completion of field work, Mr. Ells visited a number of points in the United States to investigate processes designed to recover hydrocarbons from bituminous sand.

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A. H. A. Robinson was charged with the compilation of a new edition of the general report on economic minerals of Canada, to which contributions were made by other members of the Mines Branch staff. This report was prepared at the request of the Exhibition Branch for special distribution at the British Empire Exhibition. In September, Mr. Robinson inspected current activities and developments in the silver-lead-zinc mining in southern British Columbia. Port Arthur and Sudbury were visited to note recent developments in the iron ore situation.

Arthur Buisson was assigned to accompany, as a representative of the Department of Mines, the Canadian Exhibition train in France, an urgent request having been received from the Hon. Senator C. P. Beaubien, in charge of the Exhibition train, and from the Department of Trade and Commerce, that the Department of Mines send a representative who could speak authoritatively on Canada's mineral resources. He joined the train at Rouen on July 17, and was engaged upon this service until November 30.

V. L. Eardley-Wilmot commenced an investigation of abrasive materials and their uses. He spent most of the season visiting known occurrences of natural abrasive materials, such as diatomaceous earths, silts, sands, sandstones, volcanic ash, and garnet. In all, eighty-eight localities were inspected in the Maritime Provinces, and about thirty-two in British Columbia, numerous samples being secured for laboratory examination and testing.

R. T. Elworthy of the Chemical Division began during the past season a systematic examination of Canadian natural gases. It is proposed to determine their constitution much more definitely than has hitherto been done and to obtain data with respect to the flow, pressure, specific gravity, gasoline content, and suitability for the manufacture of carbon black. Field work was confined to certain areas in southern and central Alberta. All samples obtained for analysis were examined for helium, which is becoming of increasing importance in connexion with aerial navigation.

At the request of the Dominion Parks Branch, Mr. Elworthy also made a special investigation of the radioactivity and chemical character of the radium hot springs, situated in Kootenay park, at the west end of the Banff-Windermere highway. Similar examinations were made at Halcyon hot springs on Upper Arrow lake, and at Harrison and Fairmont hot springs in British Columbia.

OFFICE WORK

Duties associated with administration and organization of the Mineral Resources Division have occupied almost the whole time of the Chief of the Division, and very little time has been available for the preparation of the reports on arsenic and other technical subjects, in progress. Field officers have been required to devote nearly one-half of their office time to the compilation of replies to the numerous inquiries that are received for technical information and to the preparation of special memoranda on the subjects with which they are familiar.

Mr. Arthur Buisson has been placed in general charge of mineral resources records and the compilation of the index of mineral resources that is being undertaken in this division.

Mr. John Casey has been placed in charge of the collection, compilation, and filing of statistical records covering production, trade, and prices, etc., in the mining industry, and the preparation of all statistical data required for correspondents or for the use of officers of the branch in the preparation of reports.

ORE DRESSING AND METALLURGICAL DIVISION

The Ore Dressing and Metallurgical Division determines methods and processes applicable to the treatment of ores submitted for test and investigation, and carries on research into special problems connected with the treatment of Canadian ores. The test work is done in great detail and usually involves a considerable amount of research.

W. B. Timm, Chief of the Division, devoted a month's time to a survey and study of recent metallurgical developments in British Columbia. He represented the Mines Branch on a tour of the American Institute of Mining and Metallurgical Engineers through the mining districts of northern Ontario and the asbestos fields of Quebec. In company with C. S. Parsons, a number of ore-dressing plants were visited in New York state.

Mr. Timm reports that a large amount of experimental work was conducted on Canadian ores, that reports were made thereon, and that satisfactory progress has been made on those investigations not brought to completion.

C. S. Parsons conducted the following investigations:

- Selective flotation tests on Sullivan ore from Kimberley, B.C.
- Concentration by selective flotation of pyritic ore from Eustis, Que.
- Concentration of the copper-nickel-cobalt ore from Shebandowan lake, Ont.
- Metallurgical treatment of Cranberry Head gold ores, N.S.
- Concentration of graphite ore from Guenette, Que.
- Concentration of molybdenite ores from Amos, Que.
- Treatment of an arsenical gold ore from Bathurst, N.B.
- Survey, sampling, and concentration tests of tailing dumps, Naughton, Ont.
- Concentration of zinc-iron middling dump at Notre-Dame des Anges, Que.

At the request of the Eustis Mining Company, Eustis, Que., he visited their new concentrator and from the knowledge gained in conducting the experimental work on the ore, was able to assist materially in putting the plant into successful operation. In company with R. K. Carnochan he visited the milling and concentrating plants of Porcupine, Kirkland Lake, and Cobalt districts, to study the recent developments in metallurgical practice in these camps. He prepared an article for the technical press on selective flotation.

R. K. Carnochan conducted the following investigations:

- Selective flotation tests on copper-gold ores from Rossland, B.C.
- Concentration of copper-gold ore from Surf inlet, B.C.
- Experimental tests on the Kirkland Lake ores.
- Treatment of gold ore from Rouyn township, Que.
- Concentration of copper ore from Allenby mountain, B.C.
- Concentration of garnet from Barry Bay, Ont.
- Preparation of mica for splitting.

Besides the investigations given above a large amount of test work of a more simple nature was conducted as follows:

Grinding tests on calcite, dolomite, quartz, sandstone, shale, mica and chlorite schists, peat, etc.

- Two shipments of clay were prepared for the Ottawa public schools.
- A sample of asbestos fibre was tested for the Department of Trade and Commerce.
- Removal of magnetic iron from asbestos fibre.
- Gold tailing sample for the Geological Survey.
- Lead-zinc ore from the Shepherd Mining Company, Riodel, B.C.
- Supposed copper ore from Cranbrook, B.C.
- Arsenical gold ore from Montague, N.S.
- Dyke sample from Usk, B.C.
- Supposed copper ore from Bull River, B.C.
- Mineralized sample from Fall Brook Mining and Development Company, Woodstock, N.B.
- Gold ore from Seine river, Ont.
- Asbestos from Yale, B.C.

H. C. Mabee, besides allotting and supervising the work of the chemical laboratories of the division, and conducting with the assistance of the laboratory assistant the fire assay work, devoted considerable time to the supervision of fitting up the new addition to the chemical laboratories and the installation of new apparatus in these laboratories. He made a study of the results of the selection flotation of the low-grade nickeliferous pyrrhotite ores with respect to the behaviour of the precious metals, and to the elimination of the barren pyrrhotite content. Although the work of the chemical laboratories was interrupted by changes in the staff, and by rearrangements and additions to the laboratories, he reports that more work was accomplished than in any year since the war. The regular routine work was of the usual wide variety, some 4,800 chemical determinations having been made on 1,295 samples of ores, concentration and metallurgical products, from the investigations being conducted in the laboratories of the division.

R. J. Traill continued the investigation of the leaching of heavy pyritic ores and the electrolytic deposition of iron from the leached solutions. This investigation having been carried to a point where additional equipment was necessary, he devoted considerable time to the design and equipment of a new electro-chemical laboratory, to continue the experimental work on a scale in which a complete cycle of operations could be maintained. He attended a meeting of the Electro-Chemical Society in New York, and visited the pilot plant of the Milford Electrolytic Iron Company at Milford, Conn., to study the recent developments of the process at this company's works.

B. P. Coyne was engaged on analytical work in connexion with the ore dressing and metallurgical investigations, and assisted the engineers on the chemical problems encountered in conducting the investigations.

J. S. Godard during the first part of the year was engaged on analytical work. Later, he was transferred to the engineering staff and assisted in conducting the experimental work.

D. T. Fotheringham, appointed in October, 1923, to the vacancy resulting from the transfer of J. S. Godard, was engaged on analytical work in the chemical laboratories. In February, 1924, he resigned to accept a position with an industrial company.

C. L. Dewar, engaged as a temporary engineer to assist with the investigations, accepted a position with an industrial company on the completion of his temporary employment on March 31, 1923.

FUELS AND FUEL TESTING DIVISION

B. F. Haanel, Chief of the Division, reports increased activity. The technical staff was increased during the year by the appointment of R. A. Strong, grade III engineer; C. E. Baltzer, grade II engineer; C. B. Mohr, assistant chemist; and H. McD. Chantler, junior chemist. The temporary services, as chemists, of J. W. McKinney for four months, and G. B. Frost for two months, were obtained to assist in the analyses of special coal survey samples.

INVESTIGATIONS AND EXAMINATIONS MADE BY THE CHIEF OF THE DIVISION AND TECHNICAL ENGINEERS

Mr. Haanel, in addition to his regular duties, devoted much of his time to the Peat Committee in preparing its final report for publication, and to work in connexion with the Dominion Fuel Board, of which he is a member, and for which he made several trips to Montreal, Toronto, Buffalo, Syracuse, Hamilton, and Washington. He made a special trip to Regina and Bienfait in connexion with the work of the Lignite Utilization Board. He also attended the meeting

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of the American Peat Society at Washington; of the General Fuel Committee of the Engineering Institute of Canada; and of the Canadian Committee of the World Power Conference. He prepared a paper entitled: "Recent Developments in the Use of Canadian Fuel," which was read before the Canadian Pulp and Paper Association at Montreal, and a paper on "The Fuel Resources of Canada and Their Utilization for the Production of Power and Other Purposes," read before the World Power Conference in London in June. A bulletin by Mr. Haanel, entitled: "Facts about Peat," has recently been published.

E. S. Malloch continued the testing, begun in 1922, of substitute domestic fuels in the experimental domestic hot-water heating plant installed at the Fuel Testing Station. He visited the research laboratories of the American Radiator Company at Buffalo to study the methods employed there for testing household heaters. Mr. Malloch also attended to the routine work of the Structural Materials Laboratories, and assisted Mr. Haanel in the routine work of the division.

FUEL TESTING LABORATORY WORK

R. E. Gilmore, Superintendent, reports that during the year 1923 a total of 667 samples of solid, liquid, and gaseous fuels were examined. About 31 per cent of these samples were sent in from other Mines Branch divisions, from the Geological Survey, and from commercial firms and individuals. The remaining samples pertained to investigations carried out by the chemical and engineering staff of the division. An accounting of the samples analysed in the chemical laboratories under the different kinds of fuel is as follows:

Coals and Other Solid Fuels. Two hundred and seventy-two samples of different kinds of coal; 51 of coke; 16 of peat; and 18 of briquettes and miscellaneous samples were analysed according to standard laboratory methods.

Oil-shale. Forty-two samples of oil-shale from Nova Scotia were examined for oil content, etc.

Petroleum Products and Tar Oils. Fifty-eight samples of gasoline; 30 of lubricating oils; 58 of other petroleum products; 23 of shale and coal tar oils; were analysed in the oil laboratory.

Gas Samples. A total of 109 samples of coal gas and flue gas were examined in standard gas analysis apparatus.

Investigations Conducted by the Chemical Staff

Mr. Gilmore, in addition to his regular office and laboratory supervision work, made three trips to North Dakota and Saskatchewan in connexion with the work of the Lignite Utilization Board. Accompanied by Mr. Rosewarne, he visited the plant of The Nation's Oil Refineries in Montreal East and witnessed trial runs for the production of light motor spirits from gas oil, by the Ramage process.

J. H. H. Nicolls carried out the field work in connexion with a survey of the coals as mined in the Maritime Provinces. Fourteen samples from New Brunswick were collected and forty-eight from Nova Scotia. The survey, though somewhat superficial, was sufficient to afford information as to the comparative value of the coals of the different areas. The results of physical and chemical analyses were used by the Dominion Fuel Board when investigating the feasibility of using Eastern coals for the production of metallurgical coke for household purposes. Mr. Nicolls, besides continuing his classification of Canadian coals, conducted experiments on the moulding and briquetting of wet and dry peat with the addition of coal fines, coke breeze, etc.

The laboratory analyses and special tests of the above survey samples were carried out by Messrs. Nicolls, Kohl, Mohr, McKinney, and Frost. Large-scale laboratory coking tests were made, and special attention was paid to the analysis and fusibility of the ash in order to determine the non-clinkering qualities of the coke. Messrs. Gilmore, Nicolls, and Kohl also assisted in carrying out the commercial scale coking tests on the various commercial samples of coal obtained from Nova Scotia and New Brunswick in the new By-Product Recovery Coke Plant erected in Hamilton by the Semet Solvay Company.

Harold Kohl conducted carbonization tests on five Alberta coals. Experimental runs at both low and high temperatures were made on three different grades of black lignites and two different sub-bituminous coals.

A. A. Swinnerton, besides carrying out further laboratory work on oil-shales, witnessed test runs at St. John, N.B., for the recovery of oil-shale by the Hartman process. Mr. Swinnerton also assisted in the routine work of the oil laboratory.

P. V. Rosewarne supplemented his regular work on petroleum products by a survey of the quality of gasoline as sold in Canada in August, 1923, in which survey forty-eight samples were collected in ten different cities. Further work was carried out on the relation of chemical analyses of standard lubricating oils to their functioning in automobile engines. Mr. Rosewarne also witnessed the test runs on the Ramage process referred to above.

C. B. Mohr, besides assisting in the proximate analyses of special survey coal samples, carried out the analytical work on the samples of coal submitted by the engineers and the extensive proximate analyses, calorific values, etc., of samples of solid fuels sent in from outside of the division.

CERAMICS AND ROAD MATERIALS DIVISION

The appointment of Howells Fréchette as Chief of the Division became effective on January 1. L. P. Collin, ceramic engineer, was appointed to the staff and reported for duty August 27. Miss E. M. Campbell was appointed senior laboratory assistant September 1.

CERAMICS

The Ceramic Laboratories are equipped to investigate materials used in the clay industries, to determine their physical and chemical characteristics, their behaviour when subject to firing, and the purposes for which they may be used.

Mr. Fréchette devoted most of his time between July 15 and December 15, visiting clay-working plants, westward from Quebec city to Victoria, B.C., to ascertain the status of the industry and in what way the activities of the division should be directed so as to afford the best aid.

At the request of the Canadian Government Exhibition Commission, Mr. Fréchette assembled a very comprehensive exhibit of ceramic products of Canada.

Mr. Collin, in addition to routine laboratory work, conducted several investigations at the request of manufacturers of brick and electrical porcelain.

During the year one hundred and fourteen samples of clay and shale were tested in the Ceramic Laboratory.

ROAD MATERIALS

Henri Gauthier made a study of the effect of wear on roads built and surfaced during the past ten years. The object was to compare the relation of laboratory tests on stone and gravel for road surfacing with actual results

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obtained on various types of roads. Most of the provincial highways in Ontario and Quebec were examined. Particular attention was paid to the sections surfaced with gravel. Over two hundred samples of gravel were collected for examination, many of these being from the road surfacing, the balance being from the pits from which the gravel was derived. A number of samples of rock were also collected from deposits not previously sampled.

R. H. Picher continued the investigation of 1922 on road materials in Nova Scotia. He also inspected surfaced highways to ascertain the wearing quality of the surfacing materials employed. The work carried on this year concludes, for the present, the investigation of road materials in Nova Scotia, as the available sources of supply along the completed and projected highways have been examined.

Mr. Picher afterwards spent about two weeks in New Brunswick inspecting and sampling certain gravel deposits, information on which was requested by the Provincial Highways Department. Most of these lie close to the route of the so-called Trans-Canada Highway, which runs through Moncton, St. John, Fredericton, Woodstock, and Edmundston.

In addition to the testing of samples collected by the officers of the division, a number of samples submitted by various provincial highway departments, county engineers, and others, were tested for their value as road materials.

CHEMISTRY DIVISION

F. G. Wait, Chief of the Division, reports that from April 1, 1923. to March 31, 1924, the total number of specimens of all kinds examined and reported upon was 1,192.

Gerald Connell was appointed as a junior chemist, July 17. R. Turner, laboratory assistant, died July 2. F. J. Cairns, previously with the Fuel Testing Division, was appointed laboratory assistant April 1, 1924.

H. A. Leverin spent five and a half months in Saskatchewan, as assistant to L. H. Cole of the Mineral Resources Division, in an investigation of alkali deposits. In the laboratory his time has been devoted to the chemical analyses and examination of the numerous samples of cores and brines (about 400 in all) collected in the field.

R. T. Elworthy spent three months on field investigations in western Canada. (See under Mineral Resources Division.)

In the laboratory he has completed the chemical examination of the spring waters collected and the analyses of natural gas samples taken, and has also completed reports on both these investigations.

The investigation on the production of formaldehyde by the oxidation of natural gas has been continued with more encouraging results.

Two preliminary investigations, which arose from the inquiry into the prevention of smoke from the pulp mills at Three Rivers, were given some attention, viz., the products of distillation of "black liquor", and a method of producing insecticides from tobacco.

R. J. Offord, laboratory assistant, accompanied Mr. Elworthy in the field work and carried out many of the analyses in the field and in the laboratory.

E. A. Thompson completed his study of the chemical and physical properties of bentonite and submitted a report thereon.

He made chemical analyses of several minerals, metallographic examination of a boiler plate and of condenser tubes for the Department of Marine and Fisheries, mineralographic study, and analyses necessary thereto, upon Wind Pass, Wright Hargreaves, and MacIntyre mine ores.

He also made a study, at the request of the Ore Dressing Division, of proposed methods of treatment of tellurides of the Kirkland Lake area, Ont.

James Moran has been engaged in the analyses of mine air samples collected, mainly in western collieries. A total of three hundred and ninety samples have been examined, of which several were of special nature, either taken from fire areas or following outbursts of explosive gases. Still others were from mine rescue stations and were analysed as a check on life saving appliances in use thereat. Several investigations were also made at the request of the Public Works Department, of air conditions in two government buildings at Ottawa.

A. Sadler has been occupied during the greater part of the year with routine analyses and assays. He also assisted in the investigatory work on bentonite.

DOMINION OF CANADA ASSAY OFFICE, VANCOUVER, B.C.

George Middleton, manager of the office, reports the receipt of deposits during the calendar year ended December 31, 1923, as follows:

During the year there were 1,639 deposits of gold bullion received, melted, assayed, and purchased, aggregating in weight 129,043.63 troy ounces, the net value of same being \$2,051,369.65, requiring a total of 1,709 meltings and 1,709 assays (in quadruplicate) in connexion with the purchase and disposal of the bullion, including the melting into large bars of the smaller deposits after purchase and the assaying of same prior to shipment to the Royal Mint, Ottawa.

The aggregate weight of deposits before melting was 129,043.63 troy ounces and after melting 124,546.48 troy ounces, showing a loss in melting of 3.4850 per cent. The loss in weight by assaying was 25.21 troy ounces, making the weight of bullion after melting and assaying 124,521.27 troy ounces, the average fineness of same being 0.794³/₄ gold and 0.152 silver.

The deposits were derived from the following sources:

	Number of deposits	Before melting and assaying	After melting and assaying	Net value
		Troy ozs.	Troy ozs.	
<i>Bars, Nuggets, and Dust, Amalgam, etc.—</i>				
British Columbia.....	649	49,912.71	46,615.62	\$ 809,820 12
Yukon Territory.....	503	73,360.82	72,689.77	1,201,132 79
Alaska.....	2	5.30	4.61	69 12
Siberia.....	2	52.40	49.69	898 41
<i>Dental and Jewelry Scrap—</i>				
British Columbia.....	404	4,749.92	4,297.03	32,817 63
Alberta.....	39	746.52	685.23	3,984 33
Saskatchewan.....	38	208.43	173.23	2,552 73
Manitoba.....	2	7.53	6.09	94 52
	1,639	129,043.63	124,521.27	\$ 2,051,369 65

DRAUGHTING DIVISION

H. E. Baine, Chief Draughtsman, reports as follows respecting the preparation of maps, charts, etc.:

Maps Published During Fiscal Year

613. Dominion of Canada mineral map, British Empire edition; scale 100 miles to 1 inch.
Map of property of the Van-Kel Chemical Co., Ltd., Saskatchewan; scale 700 feet to 1 inch.

Maps Completed but not Published

- Map showing molybdenite occurrence in Quebec and the Maritime Provinces; scale, 35 miles to 1 inch.
Map showing molybdenite occurrences in Ontario; scale, 35 miles to 1 inch.

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Map showing molybdenite occurrences in British Columbia; scale, 35 miles to 1 inch.

Map showing molybdenite occurrence in Manitoba; scale, 35 miles to 1 inch.

Map showing molybdenite occurrences in Atlin Mining Division; scale, 35 miles to 1 inch.

Map showing molybdenite occurrence in northern British Columbia; scale, 35 miles to 1 inch.

Harricanaw map-area showing Indian peninsula and Benjamin deposits, Quebec, Quebec; scale, 10 miles to 1 inch.

Maps in Preparation

Bituminous sands of northern Alberta; nine maps, comprising thirty sheets compiled on a scale of 1,000 feet to an inch, are being prepared for photolithography and will be published on a scale of 40 chains to 1 inch.

One hundred and eighty page maps, drawings, charts, and flowsheets were prepared during the year.

Two hundred and fifty negatives and black and white prints were made from the photostat machine.

Three hundred and twenty-five negatives, black and white, and blue prints were made from the blue print machine.

One hundred and twenty-five halftone blocks and zinc cuts were sent out, received, and filed during the year.

The personnel of the staff consists of two senior map draughtsmen, and one map draughtsman. H. E. Newland, senior map draughtsman (temporary), resigned, October 31, 1923. Another attempt was made in January, 1924, to secure by advertisement and examination, a senior map draughtsman, for temporary employment, pending the reclassification of the draughting staff. Six candidates applied, but none qualified.

DISTRIBUTION OF PUBLICATIONS

G. W. Richardson, supplies clerk, reports the distribution of Mines Branch reports, bulletins, memoranda, maps, press bulletins, lists of mines, etc., for the fiscal year ending March 31, 1924, as 33,140 copies, the details of which are as follows:

Requests for publication.. . . .	4,798
Casual requests—for maps, bulletins, memoranda, lists of mine operators, etc...	10,432
Mailing lists (including mine operators).. . . .	17,910
Total.	33,140

LIBRARY

Mrs. O. P. R. Ogilvie, Librarian, reports:

Additions to the Library, 1923:

Books (by purchase).. . . .	209
Books (by gift).. . . .	4
Canadian Government documents (by exchange).. . . .	527
Foreign Government documents (by exchange).. . . .	899
Scientific societies, bulletins, proceedings, and transactions (by exchange and gift).. . . .	528
Pamphlets (by gift).. . . .	149
Trades catalogues (by gift).. . . .	139
Maps (by exchange).. . . .	76
Periodicals subscribed for.. . . .	169
Periodicals received by exchange.. . . .	89

For greater permanence of record and convenience of reference, periodicals and other serial publications were bound in 209 volumes.

During the year a large amount of reference work has been done for the staff, and also for the many representatives of industry who have consulted the library. Scientific articles have been translated, abstracts made, and bibliographies have been prepared.

Bulletins, proceedings, and transactions of nearly all the most important technical societies, both foreign and domestic, are now on the files; these, with few exceptions, are received complimentary, either by exchange for the monographs and reports issued by the Mines Branch, or by gift. Again, attention must be drawn to the fact that the Library has grown far beyond the accommodations provided.

EXPLOSIVES DIVISION

Lt.-Col. G. Ogilvie, Chief Inspector of Explosives

Licences are in force covering the operation of fifteen factories, a decrease of one owing to the abandonment for manufacturing operations of the plant at Brandon owned by the T. W. Hand Firework Company. Four of the fifteen licences are for fireworks factories, one of which, that of the International Fireworks Company at London, Ontario, was not in operation. The Canadian Explosives Company's factory at Nobel, Ontario, for the manufacture of blasting explosives, also was not in operation.

The increase in total production was, however, very marked. Over 14,300 tons of explosives of classes 1 to 4, comprising the various blasting explosives, with a small quantity of propellant powders, were manufactured in 1923, an increase of 25 per cent over that of the preceding year. The output of detonators and electric detonators showed an increase of 45 per cent, and that of fireworks an increase of over 9 per cent.

Factory rules and regulations were found to be well observed. The care taken by the manufacturers in the furtherance of good practice has made possible the exceptionally satisfactory record of the year. Notwithstanding the conditions inseparable from effecting a substantial increase in production, no accident involving personal injury occurred in the manufacture of explosives.

The number of magazines under license or continuing certificates is now one hundred and ninety, an increase of forty-one. There are also one hundred and forty-four temporary magazines under licence, an increase of fourteen. The policy of encouraging the improvement or replacement of magazines for which continuing certificates had been granted has been continued. Inspectors of the division and deputy inspectors of the Royal Canadian Mounted Police found evidence of improved conditions, where improvements were called for, and found also a more extended appreciation of the requirements of the regulations.

The premises of dealers who keep rifle cartridges or such small quantities of explosives as may be kept without a licence, have been inspected as far as has been practicable by inspectors of the division, but the enforcement of the regulations governing such keeping is mainly due to the activities of the Royal Canadian Mounted Police and the admirable manner in which the members of that force have instructed and guided dealers throughout the Dominion in the aims and requirements of the regulations. It has not been possible to cover, by inspection visits, certain sections of Ontario and Quebec as fully as other parts of the country. This is due to the limited personnel available; but the work is being pushed forward as rapidly as circumstances permit.

Legal proceedings were not required or taken against any factory or magazine licensee, but sixteen charges resulting in fifteen convictions were laid during the year ending March 31, 1924, against persons for infraction of the regulations dealing with the keeping of explosives in unlicensed premises. Convictions were also obtained, on three charges, of violating the regulations, governing the conveyance of explosives by road, and on one of being in possession of an unauthorized explosive.

Four hundred and eighty-eight permits for importation were issued during the year under review.

Samples of one hundred and twenty-two explosives and fireworks were submitted for authorization, one hundred and six being accepted and sixteen rejected. Examination of samples taken from current work showed satisfactory adherence to the original specifications and samples. Deteriorated and unserviceable explosives, amounting to 1,876 pounds, were found in seventeen places, and 9,012 pieces of unauthorized fireworks, found in twelve stores, were handed over for destruction.

A detail of the accidents with explosives which occurred during the year 1923 and of which information was obtained, is given in the annual report of the division. Eight minor accidents, mainly of technical interest, and not involving injury to personnel, are recorded as having taken place in factories. One magazine was destroyed by a forest fire, no one being injured. One person was injured by the explosion of a partly filled case of dynamite, brought about by fire. The explosive was not stored as required by the regulations, and the owner was prosecuted, convicted, and fined.

With the exceptions of the above cases the accidents recorded, in all one hundred and eighty-three, by which forty-three persons lost their lives, and one hundred and sixty-four were injured, occurred in circumstances not immediately controlled by the Act.

The great majority of these accidents are undoubtedly due to the carelessness of users of explosives in either of two regards: failure to so safeguard and account for their explosives as to preclude the possibility of their eventually falling into the hands of persons, who, ignorant of the danger, tamper with them to their own injury; or failure to exercise proper and reasonable precautions in actual use of explosives. Two pamphlets have been issued and widely circulated by the division dealing with these two features, entitled, respectively, "Explosives—Warning," and "The Handling of Explosives."

EDITORIAL DIVISION

William McInnes, Editor-in-Chief

In all, forty-two separate publications were issued by the Department during the fiscal year, consisting of annual reports, memoirs, bulletins, pamphlets, and lists, and including volumes III and IV, "Insects" and "Botany," of the series of reports embodying the scientific results of the Canadian Arctic Expedition 1913-1918; also a Bulletin of the Museum entitled "An Album of Prehistoric Canadian Art," which is intended to encourage a more widespread use of distinctively Canadian designs by manufacturers and to indicate sources from which they may be derived; and an interim report of the Dominion Fuel Board.

Eight reports were published in French and 14,554 copies were distributed.

The following lists include the publications issued by the various divisions of the Department during the fiscal year 1923-1924, and the French publications distributed during that period:

DEPARTMENT OF MINES

English Publications

No.

2005. *Report of the Department of Mines for the Fiscal Year Ending March 31, 1923*; 58 pages; 1 chart; 4,000 copies; published November 30, 1923.

French Publications

1973. *Rapport du Ministère des Mines pour l'année financière se terminant le 31 mars 1922*; 50 pages; 1,000 copies; published August 17, 1923.

GEOLOGICAL SURVEY

English Publications

1975. Bulletin No. 37. Anthropological Series 8. *An Album of Prehistoric Canadian Art*—by Harlan I. Smith; 195 pages; 84 plates; 3,000 copies; published June 1, 1923.
1986. Memoir 134. Geological Series 115. *Brockville-Mallorytown Map-area*—by J. F. Wright; 63 pages; 4 plates; 2 figures; 1 map; 2,500 copies; published July 29, 1923.
1989. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1922, Part A*; 145 pages; 3 plates; 11 figures; 4,000 copies; published September 5, 1923.
1990. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1922, Part D*; 98 pages; 12 figures; 5 maps; 3,500 copies; published August 28, 1923.
1999. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1922, Part C*; 91 pages; 5 plates; 11 figures; 3 maps; 3,000 copies; published October 31, 1923.
2000. *Index to Separate Reports 1906-1910 and Summary Reports 1905-1916, of the Geological Survey, Department of Mines*—by F. J. Nicolas; 305 pages; 5 maps; published October 5, 1923.
2001. *Summary Report of the Geological Survey, Department of Mines, for the Calendar Year 1922, Part B*; 135 pages; 6 plates; 6 figures; 2 maps; published October 25, 1923.
2004. *Carton Containing Maps and Plans of the Fraser River Investigation*; 500 cartons; published December 31, 1923.

No.

2008. Memoir 135. Geological Series 116. *Geology of Fraser River Delta Map-area*—by W. A. Johnston; 87 pages; 6 plates; 1 map; 3,500 copies; published December 31, 1923.
2010. Bulletin No. 38. Geological Series 43. *Contributions to Vertebrate Palæontology*—by Charles W. Gilmore; 89 pages; 12 plates; 17 figures; published March 25, 1924.
- Report of the Canadian Arctic Expedition 1913-1918*¹—Volume III: *Insects*. Parts A to L bound under one cover; 1,000 copies; published February 9, 1924.
- Volume IV: *Botany*, Part C, *Fundi*—by John Dearnness; 24 pages; 3,500 copies; published June 1, 1923.

French Translations

1976. Mémoire 127. Série géologique, n° 108. *La région de Beauceville, Québec*—by B. R. MacKay; 117 pages; 13 plates; 7 figures; 2 maps; 1,000 copies; published August 20, 1923.
2002. *Rapport sommaire de la Commission géologique, du Ministère des Mines, 1922, Partie D* (Extract); 90 pages; 9 figures; 2 maps; 1,000 copies; published February 4, 1924.
2003. *Minéraux industriels*. Pamphlet for distribution in France on the Canadian Exhibition train; 12 pages; 4,500 copies; published August 20, 1923.

MINES BRANCH

English Publications

555. *Silica in Canada: Its Occurrence, Exploitation, and Uses. Part I, Eastern Canada*. Report on—by L. Heber Cole; 126 pages; 15 plates; 16 figures; 7 maps; 4,000 copies; published July 26, 1923.
586. *Summary Report of Investigations Made by the Mines Branch, Department of Mines, During the Calendar Year Ending December 31, 1921*; 346 pages; 20 plates; 15 figures; 21 diagrams; 3,000 copies; published June 2, 1923.
- Note.* The following parts of the Summary Report were also issued separately:
588. *Mineral Resources and Technology*; 70 pages; 2 figures; 1,000 copies; published May 30, 1923.
589. *Ore Dressing and Metallurgy*; 135 pages; 12 plates; 9 figures; 500 copies; published June 12, 1923.
590. *Fuels and Fuel Testing*; 45 pages; 3 figures; 21 diagrams; 500 copies; published June 12, 1924.
591. *Ceramics and Road Materials*; 63 pages; 500 copies; published May 30, 1923.
605. *Summary Report of Investigations Made by the Mines Branch, Department of Mines, During the Calendar Year Ending December 31, 1922*; 273 pages; 5 plates; 17 figures; 11 diagrams; 3,000 copies; published February 29, 1924.
614. *Facts about Peat*. Report on—by B. F. Haanel; 48 pages; 15,000 copies; published January 29, 1924.
1. *Interim Report of the Dominion Fuel Board, 1923*; 31 pages; 4 maps; 1 diagram; 3 charts; 7,500 copies; published June 14, 1923.
- Experimental Ore Testing and Research Laboratories*. Pamphlet; 2,000 copies; published October 10, 1923.

Lists of Mine Operators—

- List of cement mills and sand-lime brick plants in Canada; published April 14, 1923.
- List of lime kilns in Canada; published May 7, 1923.
- List of non-metal mines in Canada; published May 17, 1923.
- List of manufacturers of clay products in Canada; published June 18, 1923.
- List of stone quarry operators in Canada; published June 23, 1923.
- List of petroleum and natural gas wells; published June 23, 1923.
- List of sand and gravel operators in Canada; published July 7, 1923.
- List of metal mines in Canada; published September 15, 1923.
- List of metallurgical works in Canada; published February 22, 1924.

¹ These reports were published under the supervision of R. M. Anderson, Chief, Biological Division.

SESSIONAL PAPER No. 15

French Translations

No.

573. *Rapport sommaire des investigations de la Division des Mines, du Ministère des Mines, durant l'année civile se terminant le 31 décembre 1920*; 92 pages; 7 figures; 1,000 copies; published August 8, 1923.
2. *Rapport intérimaire de la Commission du Combustible, 1923*; 32 pages; 4 maps, 1 diagram; 3 charts; 2,500 copies; published June 25, 1923.

EXPLOSIVES DIVISION

English Publications

9. *Explosives—Warning*. Pamphlet by Lt.-Col. G. Ogilvie; 12 pages; 5,000 copies; published October 15, 1923.
11. *The Handling of Explosives*. Pamphlet by Lt.-Col. G. Ogilvie; 12 pages; 10,000 copies; published March 18, 1924.

French Translations

8. *Rapport annuel de la Division des Explosifs, du Ministère des Mines, pour l'année civile 1922*; 21 pages; 1,250 copies; published August 9, 1923.
10. *Explosifs—Prenez garde*. Pamphlet by Lt.-Col. G. Ogilvie; 12 pages; 2,500 copies; published November 14, 1923.

REPORTS IN PROGRESS ON MARCH 31, 1923

At the end of the fiscal year 1923-1924 the Geological Survey had in the hands of the King's Printer nine English reports; the Mines Branch, two English reports and one French translation; the Explosives Division, one English report and one French translation. The French translation of the Annual Report of the Department of Mines for the fiscal year 1922-1923 was also in the press.

DISTRIBUTION OF FRENCH PUBLICATIONS

The French publications of the Department of Mines, including those of the Geological Survey, the Mines Branch, and the Explosives Division, are distributed under the supervision of the Editorial Division of the Department. During the fiscal year 1923-1924, 14,554 copies were distributed in Canada and foreign countries, as follows: 2,180 copies to addresses on the mailing lists; 5,274 copies in compliance with written or personal requests. In addition 2,400 copies of the Interim Report of the Dominion Fuel Board and 450 copies of the report of the Explosives Division were distributed by these offices to their correspondents; and 4,300 copies of "Minéraux Industriels du Canada" were distributed from the Canadian Exhibition train in France.

ACCOUNTING DIVISION

ACCOUNTANT'S STATEMENT

P. R. Marshall

The funds available for the work and expenditure of the Department of Mines for the fiscal year ending March 31, 1924, were:

	Grant	Expenditure	
		Amount	Total
	\$ cts.	\$ cts.	\$ cts.
DEPARTMENT—			
Amounts voted by Parliament.....	98,644 99		
Civil list salaries.....		62,680 00	
Expenses of Explosives Division.....		7,881 38	
Grant to Imperial Mineral Resources Bureau.....		7,300 00	
Civil Government contingencies.....		6,424 56	
Grant to Canadian Institute of Mining and Metallurgy..		3,000 00	
Provisional bonus allowance.....		2,464 99	
			89,750 93
Balance unexpended and lapsed.....			8,894 06
GEOLOGICAL SURVEY—			
Amounts voted by Parliament.....	645,419 13		
Civil list salaries.....		271,938 20	
Explorations, surveys, and investigations.....		177,409 13	
Publication of reports and maps.....		44,788 60	
Wages of temporary employees.....		25,856 66	
Sundry printing and stationery.....		19,753 19	
Provisional bonus allowance.....		10,979 13	
Miscellaneous.....		3,994 81	
Instruments and repairs.....		4,329 27	
Photographic supplies.....		1,439 57	
Laboratory.....		795 30	
Specimens for Museum.....		2,621 11	
Miscellaneous gratuities.....		630 00	
			564,534 97
Balance unexpended and lapsed.....			80,884 16
MINES BRANCH—			
Amounts voted by Parliament.....	422,618 67		
Civil list salaries.....		142,264 73	
Investigations of mineral resources and deposits.....		47,655 96	
Expenses of fuel testing plant and laboratory.....		30,300 40	
Expenses of the Dominion Fuel Board.....		28,118 05	
Expenses of ore dressing and metallurgical laboratory....		28,092 81	
Wages of temporary employees.....		21,167 38	
Publication of maps and reports.....		13,405 61	
Sundry printing and stationery.....		10,007 23	
Provisional bonus allowance.....		7,218 67	
Chemical laboratory.....		4,231 00	
Miscellaneous.....		2,541 63	
Miscellaneous gratuity.....		360 00	
			335,363 47
Balance unexpended and lapsed.....			87,255 20
DOMINION OF CANADA ASSAY OFFICE—			
Amounts voted by Parliament.....	26,871 38		
Earnings.....	2,694 22		
Salaries of staff.....		18,851 50	
Contingencies.....		1,600 56	
Assayers' supplies.....		1,556 58	
Fuel, power, and light.....		1,205 61	
Provisional bonus allowance.....		871 38	
Premium on bonds.....		462 50	
Electric burglar alarm service.....		360 00	
			24,908 13
Balance unexpended and lapsed.....			4,657 47
	1,196,248 39		1,196,248 39

Summary

	Grant	Expenditure	Grant not used
	\$ cts.	\$ cts.	\$ cts.
Civil Government salaries.....	533,190 00	476,042 93	57,147 07
Department.....	29,000 00	24,605 94	4,394 06
Geological Survey.....	332,000 00	280,987 64	51,012 36
Mines Branch.....	250,000 00	185,520 07	64,479 93
Assay Office..... \$ 26,000 00			
Earnings..... 2,694 22			
	28,694 22	24,036 75	4,657 47
Provisional bonus allowance.....	21,534 17	21,534 17	
Miscellaneous gratuities.....	990 00	990 00	
Increases due to reclassification.....	840 00	840 00	
	1,196,248 39	1,014,557 50	181,690 89

Casual Revenue

Government of Manitoba, grant to Lignite Utilization Board.....	\$ 31,250 00
Sales of school collections, equipment, explosives permits, etc.....	3,501 61
Amount received from Government of Ontario on account of peat fuel investigations.....	1,010 40
Refund on account of sales tax paid in 1922-23.....	142 36
Revenue from fines for violations of Explosives Act.....	114 00
Adjustment of claims for equipment damaged.....	50 00
	\$ 36,068 37

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